Synopsis

This Guide outlines the regulations for project units within the Department of Electrical and Computer Engineering at Curtin University for the:

- Bachelor of Engineering degrees
- Double degree courses in which the Department participates
- Masters by coursework degrees

The Guide covers requirements and expectations in all areas of project work and defines all procedures used. It specifically addresses Bachelor of Engineering projects, but where these significantly differ from masters then comments are made. Note too, the course coordinator is the projects coordinator for the masters theses.

With the course coordinator’s approval, some Bachelor of Technology Students will be permitted to enroll in the one semester unit Computer Technology Project 392. This has very different conditions to what is outlined here although much of it may be useful in guiding your work. You should seek clarification from your course coordinator on exactly what is required.

While this Guide is not intended for research postgraduate students, they may wish to note the sections on writing a thesis. All graduate students should note the requirements in the Graduate handbook for graduate theses.

This Guide is in the required format for the presentation of project theses and, with some slight variation, in the required style.
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1.0 INTRODUCTION

1.1 Why project work?

Engineering schools throughout the world require undergraduate and postgraduate coursework students to undertake a major project. At University students gain a broadly based theoretical knowledge and some skills plus an insight into professional practice. A second phase of education occurs in employment where they gain ‘practical experience’ in a specific area under the supervision of experienced Engineers. Some problems can result due to these two educational phases being so different. Because a student is academically capable does not imply they will be professionally competent. How, then, to judge whether a course offers a simple transition between the two and whether students can become competent professionals?

The ideal vehicle to make this judgment is a simplified version of professional practice; a project. It is simplified in the sense it is usually individual, the problem is not as detailed as those in industry or research projects and time is far more limited. However, it is still an example and will give students insights into professional practice and what they need to address so that they can succeed. Given that, you will not be surprised to learn the principal educational objective of project work for undergraduate project units is to allow you to demonstrate your potential as a professional. For coursework masters degrees, it is to allow you to demonstrate your competency as a professional engineer in a new field.
There is an important implication of these objectives. Demonstrating your professional abilities means all your abilities and that includes your attitudes, the way you manage time, your approach to solving problems of various kinds, how you discover current practice in a given field, how you learn new skills as well as technical ability.

The form of the project varies according to the course in which you are enrolled. Masters students will be looking at advanced development of which design is a part. For most students undertaking an engineering undergraduate degree including those doing double degrees design will usually be the focus. Why? Design integrates all the work done over your course and that makes it ideal for projects. That aside, it is at the heart of engineering. An appreciation of what is involved with design and its many facets is therefore of benefit no matter what aspect of the profession you ultimately enter, or at what level.

Design is not the only means for achieving the objective. Design is a process. Therefore, that process can be an object of study to demonstrate your professional ability. That is to say, a project can quite legitimately be the development of a new design method or a careful examination of one recently proposed. It can also be design at various levels. Most projects look at the lowest – the component level – but it can be design at the systems level where, for example, you integrate various elements of common technology.
to create a new and useful system. A project can also be a study of a new method of manufacture or a new means of operating existing systems. It can be a research project although this is not that common at an undergraduate level. It could also be a forensic examination to determine why a given system fails. It can take other forms, too, but no matter what a project may be it must be a task requiring systematic work and so allowing you to demonstrate your ability. Most projects for engineering students are design projects simply because that is the most convenient path for this.

There are four critical activities in all projects:

1. *Selecting a project*

   This is not as simple or as straightforward as it may seem.

2. *Creating a project plan*

   Any engineering project is carefully planned, then the plan is implemented. Thus the importance of Project Management to Engineering. If the project is to reflect professional practice, you to need to identify how you will spend your time and available resources to solve the problem allocated and write this down. You also need a regular review process. If you are not on-plan then you need to determine appropriate action to take – in consultation with your supervisor – so that your project can reach a satisfactory conclusion. An important point. By creating a plan, both you and your supervisor know exactly what you will achieve.
3.  **Executing the project**

Naturally, the plan must be implemented. This must be done in a professional manner, and as part of that you are required to keep a logbook to record activities, data, thoughts and so forth.

4.  **Communicating the project outcomes**

For most of you, this will involve three actions. First, you will give a short seminar to your peers and the academic staff. Second, you will write a thesis. Third, you will create a poster. There are some conditions on these outlined later in this document.

Various sections of this document will discuss each of these issues in detail. However, a comment on the thesis. On graduating, how do you prove to an employer that you are the person they need? Comparing the academic records of graduates from different universities tells little. However, your project tells them exactly what they need to know; the intellectual and professional skills you can bring to their organisation. Thus in the interview – where they discover if you have the personal skills as well – **ALWAYS** present an CD or stub of your thesis. It is your best advertisement.

### 1.2 Objectives and outcomes of project work

As outlined, the key objective of undergraduate project work is as follows:

> *To give students the opportunity to demonstrate their potential as a professional in their chosen field*
In the case of coursework masters, the objective of project work is as follows:

*To give students the opportunity to demonstrate their competency as a professional area in a new field of endeavour*

Given these broad objectives, project is asking you to demonstrate your ability in these directions:

1. *Process skills*

   Your ability to:
   
i. analyse a complex problem and identify the key issues in its solution;
   
ii. review and develop an understanding of current and related practice in solving problems of this general type;
   
iii. formulate requirements and then design specifications for solving the problem where this includes design studies to identify the best specific approach to solving the problem;
   
iv. formulate a plan to solve the problem subject to the time and resource constraints set by a project unit;
   
v. carry out a design according to that plan that will solve the problem in accordance with specifications.

2. *Activity management*

   Your ability to:
   
i. realistically use the time available to you;
   
ii. review progress with others and to formulate appropriate remedial action of this is needed.
3. **Professional skills**

Your ability to:

i. exercise appropriate judgment;

ii. demonstrate appropriate interpersonal skills in dealing with others who you need to assist you in solving your project problem;

iii. employ IT appropriately for completing your project;

iv. demonstrate an appropriate understanding, where applicable, of the social implications, the environmental considerations, the ethical constraints and related concerns of your project.

4. **Learning skills**

Your ability to:

i. identify new knowledge and/or skills you require to solve your project;

ii. learn that knowledge and/or skills.

5. **Communication skills**

Your ability:

i. to effectively communicate work done orally with the support of multimedia;

ii. to produce a well-written thesis that precisely conveys the work you have done;

iii. to succinctly describe your achievements via a poster.
In an overall sense, you need to address all of these in your project work, but there is a complication. Project is conducted over two semesters and each is separately assessed to determine if you have met the unit outcomes. Clearly, you need to be aware of what specifically are the outcomes of each semester. This is discussed in a later chapter, but the broad division is that:

1. the first semester is devoted to the execution phase of project; the outcomes applying are all those except for the thesis and poster;
2. the second semester is mainly devoted to the communication aspects of project, but is clearly influenced by the others.

Looking back at the previous divisions, you will notice there are four elements to project work. For the other two:

1. Undergraduate students are expected to select your project at least one semester ahead of when you begin work. Masters students are assumed to have some experience of planning engineering projects and need to create a plan immediately on enrolling.
2. You are required to develop your project plan between selection and commencement. **You cannot proceed unless your plan has been approved**, and the final date for that is the HECS cut-off date in that first semester. Unless a project plan is presented, your enrolment will be automatically cancelled. You will not suffer any HECS penalty, but there are AusStudy implications plus Visa implications for international students.
In undertaking project, you are undertaking a rather unusual pair of units. For most units you cover exactly the same material as every other student, you are assessed in exactly the same way and your opportunities for gaining a high grade are the same. None of that applies to project. You do an individual project, you are individually assessed and the opportunities depend on you, the project and your supervisor. All that is in common is that you and your peers all do a unit covering ‘professional practice’ and that in turn provides you with some ‘practical experience’.

In the course of doing project you will discover you need to learn new skills. You will also see some subjects in an entirely new light. The frustrations of obtaining components, of making something work when ‘there is nothing wrong with my design’, of trying to remember material covered some years earlier and now rather important to complete a task are all wonderfully character-building. So, for that matter, is discovering that components are not the nice, simple mathematical models discussed in books, that thermal problems are problems and that EMC is more than three letters of the alphabet. There is also the joy of working to a strict time and financial budget. When it is all finished, you will then wonder how something so simple could involve so much pain and exasperation. Then enlightenment will fall and you will realise that in spite of years of effort, there is still much more to learn before you can truly call yourself a professional. But you will have shown your potential and ability.
1.3 An overview of the guide

Your need for information will vary over the course of the project. Chapter 2 defines the selection process and enrolment conditions. Chapter 3 is concerned with the project plan. Chapter 4 defines how to actually execute the project, Chapter 5 outlines the requirements for your seminar and poster, and then Chapter 6 defines how to write your thesis. Of course, how the project is assessed is of some interest and this is discussed in Chapter 7. Note this chapter very carefully! Finally, some general comments on project work are discussed in Chapter 8. The Guide concludes with a number of appendices. The first of these gives you a checklist for ensuring your submitted thesis is acceptable.
2.0 SELECTION OF PROJECTS

2.1 The selection process

There are three mechanisms for selecting a project:

1. You may select a project nominated by one of the academic staff.
2. You may nominate your own project.
3. You may put forward an industry-based project.

A number of conditions apply to each of these and they are discussed in the following sections. **PLEASE NOTE THESE CONDITIONS CAREFULLY.**

When do you select a project? This depends on the project:

- A masters by coursework project has to be selected quickly in the semester in which you are first enrolled. That tends to favour staff-nominated projects unless you have negotiated with a staff member prior to that or your course coordinator to approve an industry-based project.

- **Ideally, at least one semester before you plan to begin.** Why? Because your enrolment is conditional on you presenting an acceptable project plan and you need time to do that. Further, every thesis **must** have a research component - you use knowledge or skills not known to you when you began the project. You need time to read, think, reflect and develop those skills.
B.Tech projects are usually case studies or developmental. For the engineering degrees, the project is usually focused on design in some way, but it can be a pure research problem. For a masters degree, it is more inclined to an advanced development or research problem.

You are not obliged to undertake a project in your specialist area, but it is expected. A project can cross boundaries such as a microprocessor-controlled instrument for use in the power industry or a problem with linked to networks

A very important point. Can you choose a joint project? The project objectives refer to you as an individual. Therefore, you CANNOT work as a team on a project and present a single thesis. However, you can work on a joint project if you are able to present individual theses. For example, assume a group of students wanted to develop an electric car. Then a power student could make a project from the motor drive systems and possibly the power electronics associated with it, a computer engineering student could look at the overall control system examining ‘intelligent’ control and an electronics student could develop the sensors. In this case, each reports on their particular task within the overall joint project, but in their introduction outlines the joint project and references (and acknowledges) the other students.
The key decision in selecting a project is ensuring that it is going to offer you enough challenges to gain the grade you wish. Therefore, before making your final selection, you may wish to read the later chapter on assessment. Once you have selected a project, your will proceed through these stages:

1. There will be an exploration stage where you and your prospective supervisor try and determine if you are compatible and that you can indeed create a worthwhile project.

2. There is a planning stage where you determine the project plan in detail according to standard project management principles. Executing that plan is what you will actually do in project.

3. There is the enrolment stage where you actually become enrolled in the first project unit.

Do not simply pick a project; you need to explore the implications with your potential supervisor. When this stage finishes, submit a Project Registration form – signed by you and your supervisor – with the Projects Coordinator. This is, if you like, a letter of intent and, apart from keeping the Projects Coordinator aware of what is happening, commits you both.

Now begin planning your project with your supervisor. A key point in this is to define what you will have achieved at the end of the first semester – that is, at week 12 – and also on completion of the project.
Once you have completed the plan, then you need to send a copy with a cover sheet signed again by you and your prospective supervisor to the Projects Coordinator. The Coordinator will normally accept it but may seek clarification. Note that the plan is important to you in executing the project and it is also used in assessment.

You need to go through the usual enrolment process, but the Projects Coordinator can cancel your enrolment for various reasons. Enrolment is discussed in detail at the end of this chapter.

### 2.2 Academic Staff nominated projects

Some comments:

1. Academic staff may produce a list of projects they are willing to support at the beginning of each semester. These are mostly in their area of specialisation, but not always. You need to look carefully at each project to ensure it is suited to your interests.

2. Most staff prefer to work with students to develop a project topic of interest to both. A topic is not fully fleshed out so it is quite possible it may not present the range of challenges expected of a project. You need to investigate it and satisfy yourself that you can frame an acceptable project based on it.

3. Then discuss your project idea with the relevant staff member to determine their expectations of you.
4. Because you wish to do a given project does not mean that the staff member has to accept you. Therefore, a very important issue to raise in your first meeting is what conditions must you meet for that staff member to take you on?

5. Please note that until the staff member’s signature - and yours - is on the Project Registration form, then you do not have a project. By signing, the staff member is indicating their willingness to supervise you subject to you preparing a satisfactory project plan.

2.3 Student nominated projects

You are encouraged to nominate your own project topic. Be warned, this is going to take more effort than the other options, but then you will be doing exactly what you want to do. Follow this sequence of actions:

1. Read this Guide very carefully to see what is expected of a project.

2. Go to the library and the web and see what professional activity is occurring in the ears of interest to you. Then search out specific topics highlighted in papers or articles that you think meet the project criteria.

3. A good starting point is to look at the literature of about 5 years ago and identify problems that were highlighted then see if anyone has tackled them since. You will be surprised at the number that have not. Another option is to see if some brand new technology suggests a new way of performing an old action.
4. List the topics in which you are interested. Now sketch out for each what you think are the detailed problems of the topic that you will need to solve and then sketch out:

   - the time you think will be needed to do that
   - the resources you think you may need

5. If the time seems excessive, then you can reject that topic. The resources issue is more complex and will probably require some investigation. You will also need to carefully identify exactly what those resources may be:

   i. If they are physical components, then you may be able to purchase them through the Department.

   ii. If you purchase components yourself you get to keep the final prototype developed. However, you are NOT entitled to the intellectual property rights. That is, you cannot go out and sell your idea to a company. As the project was supervised by a University employee Curtin has those rights.

   iii. You may need a resource and discover there is a company that can create this for you. You cannot contract for that or commit the University to make a payment. Your only option is to pay for it yourself or ask them to donate it.

   iv. **You may not use illegal software.** Evidence of such use will see your results annulled. You may only use public domain or university supplied software, or that you paid for.
6. Once you have a topic, then you need to flesh it out. It is an idea to write a short proposal, with references, on what you plan to do.

7. Your next step is to find a supervisor. Check the interests of each staff member. Approach those who seem to best fit.

8. What happens if a staff member refuses your project? The obvious answer is find another, but before doing that, it is always an idea to find out why. It may be a simple reason like that staff member already has a number of project students. However, they may see deeper problems and it is in your interest to know those. It may be you can rework the project and try again at a later time.

9. What happens if no matter what you do no staff member is willing to supervise? You need to change the topic.

2.4 Industry-based projects

While the Department encourages you to undertake industry-based projects, we do not actively seek them out. If a company approaches the Department, we will discuss the project with them and if we find it acceptable then we will list that project on our web noticeboard. There are particular conditions that apply to these projects and you need to consider these carefully.

Most industry projects result from vacation employment or part-time employment. You can approach companies directly, but your chances of success are very low for the simple reason they do not know you.
In general, an organisation likely to offer support is:

1. a small company that needs someone to examine feasibility of a new approach;
2. a charitable organisation or company that need technical expertise in an area that is not part of their normal activities;
3. a company who see project as a way of identifying possible future employees.

An industry-based project must be conducted according to the same principles and policies as an internal Curtin-based project. That is to say, an industry project must be a supervised project. Therefore, if you can consider an industry project you need to do the following:

1. Bring this Guide to their attention and ensure they accept the requirements listed.
2. You must ensure there is someone in the organisation who can supervise you, preferably a professional engineer or possibly a scientist. It does not necessarily have to be an engineer in your field, but of course if they are going to supervise they need to know something of the topic. A supervisor cannot be an accountant, a technician, a foreman, a manager or similar. If there is any doubt over the potential supervisor, then seek clarification from the Projects Coordinator.
Two critical legal issues associated with industry-based projects. The Department’s only interest is that you are properly supervised and that you can be assessed in the same manner as any other project student. Issues of payment for services, assigning of intellectual property rights and so on are entirely an issue between you and the organisation concerned. If you have concerns, especially over the latter, then seek legal advice.

A company is extremely unlikely to get you to develop a product; rather, it is more likely to be interested in you proving feasibility. If they genuinely want you to develop a product, then you should seriously question whether you wish to work with them (unless you are experienced). Further, if you do wish to proceed then you are very strongly advised to make sure you are not subject to any legal liability over the future use of this product. That is a serious issue and not to be treated lightly. Seek legal advice!

In general, any design or research you do is the property of the University because you have used University property and you are under the supervision of University staff. If you believe that work has commercial potential or is patentable, then you are obliged to approach the University on this. Your supervisor can assist. The University may choose to commercialise in which case you receive a royalty, and a quite generous one at that. If it decides not to proceed, then you may request all rights are assigned to you and do what you wish.
In the case of an industry-based project, the University will not pursue its rights provided you use no University property or seek advice from staff. That means effectively no association with the University over any matter related to the actual execution of your project. That includes you making Internet access via University machines and using university-acquired software. If you ignore this, then in blatant cases your results could be annulled. However, the more important point is that the University would be in its rights to seek compensation from the company concerned. That could be very embarrassing all around.

There is an exception to this, but there are further conditions. The Department sees ‘industry’ as any organisation external to the University. That not only includes private profit making concerns, but also charitable organisations and public research agencies like the CSIRO. In these latter cases, you may use University resources. However, again there is the issue of whether the project is proving feasibility or developing laboratory equipment, or whether it is likely to be a commercial product. If the latter, then again the question of liability arises and rights over intellectual property. You need a ruling from the Projects Coordinator.

Then:

1. Your first step in organising an industry project is to ensure you and the organisation accept the conditions listed.
2. Once you have reached your private arrangements, then the next step is for your industry supervisor to write a letter to the Projects Coordinator (on the organisation’s letterhead). That letter needs to state the following:

i. The organisation is prepared to conduct a project in accordance with Departmental rules.

ii. The qualifications and experience of the person who will supervise. This does not have to be very elaborate. For example, it can be as simple as “XXXX has been a member of the I.E. Aust for seven years and is currently responsible for selecting and managing the installation of instrumentation”. The objective is simply to allow the Department to establish that person understands the supervision process, has some experience of it and can supervise.

iii. Where appropriate, the organisation accepts that there has to be a separation from University activities and that it has or can make available all resources needed.

iv. An indication on whether the industry supervisor wishes to be a co-examiner of the thesis. This is not necessary, but many do and the Department has no objection.

v. Critically important, the organisation MUST accept the publication requirements. (See ahead)

The Projects Coordinator will reply to this letter.
3. You should separately submit brief overview of the project plus a Project Nomination form. **NOTE YOU DO NOT HAVE TO FILE A PLAN WITH THE PROJECTS COORDINATOR.**

That is all that is required. Please also note the following:

1. You **MUST** submit your project plan to your industry supervisor. They need to indicate to us that it is acceptable by the due date.

2. You are **NOT** required to submit a patent assignment form with Curtin, but you **DO** need to submit a copyright form.

We require your thesis to be a **public** document; we keep a physical copy in the Department and we put an electronic copy on our servers. **We require an industry partner to acknowledge this.** This gives the Department legal protection if at some later time they state this prevented a patent claim or that information was disclosed to a competitor.

If your project is indeed to prove feasibility, then they may later commission a detailed engineering design or seek a patent. In that case, they would certainly desire the information be kept confidential. The Department recognises that. Therefore, it will, for a short time only, keep a thesis confidential. We expect the organisation to nominate for how long they require confidentiality and why. Simply stating “commercial reasons” is not adequate. Further, the **maximum** period the Department will consider is three semesters.
What to do if this is still unacceptable. Should it happen - and it can if you are a full-time employee - then an option to explore is to change the project so it now covers only part of the activity, or you explore a related method that for various reasons you do not intend to follow commercially. You may try and convince the company that the thesis is not that public as few people would think to look to us. Otherwise, you have few options.

You do not have to identify a project as being industry based in your thesis. Normally, in the acknowledgements section of the thesis you would include a statement of the form:

This project was supported by XXXX. The author thanks the company for making its facilities available, and particularly thanks YYYYY, his/her supervisor. In addition, ZZZZZ who assisted in ....

It may be diplomatic to ask if this should it be reduced to something like:

The author gratefully acknowledges the support of XXX of YYYYY for part of the supervision of this project and for making particular resources available. ...

Industry-based projects differ from those within the Department as follows:

1. The first semester assessment is entirely conducted by your industry-based supervisor. They need to send the Projects Coordinator a letter at the end of your first semester telling us whether progress has been satisfactory or not.
2. For your second semester, you need an academic supervisor at Curtin to help you give your seminar and write your thesis. You need to organise that supervisor thus it is advisable to approach staff during the first semester of your project.

3. Please note that any draft of your thesis must be vetted by your industry supervisor to ensure you are not disclosing any confidential or proprietary information.

2.5 Enrolment in project units

Given the previous objectives, you enrol in a project unit:

1. in your third year of a B.Tech;

2. when you have completed at least five and preferably six semesters for a B.E, and for the equivalent semesters of the B.E. for double degree students;

3. immediately for one year masters, or the second year for a two.

Enrolment in the project units for B.E. students is a little complex:

1. Enrolment is conditional for the first project unit until the conditions listed below are satisfied.

2. You must submit a project registration form by the first week of semester to remain enrolled.

3. At the HECS cut-off date, your enrolment will be automatically cancelled if you have not submitted by then:
1. signed the patents clearance form (unless you are doing an approved industry project);
2. presented an acceptable project plan, signed by you and your supervisor and submitted to the Projects Coordinator;
3. signed the copyright form so that your thesis can become a public document.

If your enrolment is cancelled, this has implications for HECS, for AusStudy and if you are an overseas student your student visa.

Most project work is done as two units. You can begin project in either semester provided a supervisor is available. Your first project unit is assessed pass/fail meaning that your progress is satisfactory. If you fail, clearly you may not proceed to the second project unit.

Can you do both project units in one semester? Yes, but this is strongly discouraged as to succeed you have to spend the preceding vacation period working intensively on your project. If you present an acceptable thesis, then clearly your ‘progress’ in the first semester unit was satisfactory. However, if your thesis is not satisfactory, you can be failed in both project units.

Can you do the first project unit, wait a semester, then do the second. How you manage time effectively is a key assessment issue in project and this does not allow that. This option is strongly discouraged.
The nature of project is that you work to a plan you have devised. You meet regularly with your supervisor to report to on progress, to seek guidance if needed, and, if the project is not being executed according to the plan, to jointly devise a plan of action to amend the plan. You should be able to adjust your plan to compensate for a slight illness. For a more serious illness or problem - you are in a road accident, a close relative or friend dies, you are involved in a lengthy court case - then you need to consider withdrawing. You suffer no penalty for that and in such circumstances you can make a good case for a special late withdrawal.

You **CANNOT** seek a deferment for project units and **none** will be considered. Your ability to manage time effectively is a critical part of project. To ask for a deferment is a clear statement you cannot.

### 2.6 Summary

**Enrolment**

- Leave it to your last semester or as close to that as possible
- Do the units either together or consecutively

**Sequence**

- Begin planning a semester ahead
- Read, investigate, negotiate
- Begin work on the project plan
- Submit a Project registration form to the projects coordinator.
The project registration form

An agreement between you and your supervisor to work together

Outlines what is expected of you

Conditions

You do not have to do a project in your area, but it is expected.

YOUR ENROLMENT IN THE FIRST PROJECT UNIT WILL BE CANCELLED IF YOU DO NOT SUBMIT A PROJECT REGISTRATION FORM BY WEEK 1.

YOUR ENROLMENT IN THE FIRST PROJECT UNIT IS NOT FULLY ACCEPTED UNTIL YOU SUBMIT A PLAN, THE PATENTS FORM AND THE COPYRIGHT FORM

Types of projects

Staff supervised

Your own

Identical to staff, but you have to find a willing supervisor

Industry supervised

You must work at their premises

We need a letter saying they can supervise, they have the facilities and they accept the final thesis is a public document
3.0 PLANNING THE PROJECT

3.1 Introduction

Engineering is creative and disciplined. At the heart of good engineering is planning and that is why project management is such an important topic. To simplify the situation, any engineering problem begins with some task to achieve. Two immediate issues have to be addressed:

- **What resources are available?**
  That is, what materials, skills, money but especially time.

- **What constraints exist?**
  When can certain people or resources be available?

Planning is a two-stage process that answers these key questions:

- **How to reach the goal?**
  Define a sequence of activities that will do this. Note which can be done concurrently and which are dependent on each other.

- **How to allocate resources**
  Determine what resources, and again especially time, can be allocated to each task.

This last stage is NOT identify what resources are needed; it is what can be allocated. This is especially true of time. If the resources needed are identified, then this pre-supposes an approach to the task. Knowing what is a reasonable allocation of resources, though, forces a search for the optimum approach in the context of the overall project.
This last point is very important to stress. To give a simple example, you may need some software for your project. You could write it yourself but that would take a lot of time. You could find and modify code from the web, and that would take some time but perhaps not a lot depending on the quality of the code. There is uncertainty here. It may happen you are a dab hand at Matlab programming so a third option may be to create the code in Matlab – which you can do quickly, but it may then take a long time to generate the required result. Which of these to choose is an engineering decision you make on the basis of what your plan flags is best in an overall sense.

Some students will argue they must develop the software or they will be failed or get a low grade because they did not ‘do the work’. Rubbish! You are judged on your engineering decisions – your intellectual achievements - and your plan backs you. Those who just develop code will probably fail as they won’t achieve their project objectives and fail to recognize that engineering is an intellectual discipline not manual labour.

If planning is central to the practice of engineering, then it must also be for project work. Creation of a plan, its quality and your ability to keep to it contribute significantly to your assessment. To emphasise again, a plan is created before an activity to guide it, not something created afterwards to act as a record of what was done. If you are unaware of the principles of project management, then begin reading on the subject immediately.
Recent changes to project policy have further strengthened the project management aspects of project work. There are two critical requirements.

Your enrolment is dependent on you submitting an acceptable project plan to the Projects Coordinator with a cover sheet signed by you and your supervisor showing acceptance. You may submit the plan from any time after project selection. The final date for submission however, is the HECS cut-off date. **At that time, all students who have failed to submit an acceptable plan will have their enrolment in project units terminated.** To stress again, this is the final date. It is in your best interests to submit as soon as possible. There can be NO deferment of this submission.

A very important implication of this that may have escaped your attention; **the more quickly you complete the project plan, the more time you have to work on the project.**

In industry, once a plan is in force there are periodic reviews of progress to identify delays, omissions, unidentified problems and so forth. At each review, appropriate corrective action is identified. Whenever there is a need to change the plan, the ramifications for time, budget resources and outcomes must be carefully assessed. A similar situation applies to you. **YOU MAY NOT CHANGE THE PROJECT PLAN AT WILL.** A later section discusses what to do if you need to change the plan.
In keeping with accreditation and other requirements, it is now mandatory that you keep a project logbook. This needs to record all information of relevance to your project, including the project plan. Note that in industry you need to keep a log, and this may need to be produced in court as a result of patent litigation, malpractice and so on. This implies all entries are dated.

At the start of any project, nothing is committed and nothing is accomplished. As it is executed, there is commitment as well as some accomplishment. However, the options for change become more and more limited. If a mistake is made and not detected towards the end of a project, then it becomes extremely difficult to correct. That can see pressure for unethical behaviour. Careful planning and change planning can avoid such problems. Methodical work at the start of the project is time very well spent.

3.2 Guidelines for creating a plan

In one sense, creating a plan is quite straightforward as:

1. established principles of project management need to be followed;
2. the final stage is writing a thesis and that is quite prescribed and the same for all students;
3. projects are similar in the sense they all revolve about a posed problem, determining a solution to that problem and then verifying it, plus they all face a similar means of assessment.
There is some slight variation as in practice projects tend to fall into:

1. a majority that involve a design of some form and that means recognised engineering design processes need to be followed;
2. a smaller number that are more experimental, and so tend to revolve about a test to examine a proposition, review of the implications of the results and using those to frame a further test.

The design method is used to create technology for which there is a need. Technology here is used in a general sense of meaning it can be an artifact, physical or conceptual, a design process or pure knowledge such as a plan to create an underground rail system when the existing rail system must continue operating. The design method has to consider uncertainty and risk. Uncertainly is internal issues; the skill set of the of designers, their design tools and so on. Risk is external issues; a component is withdrawn from the market. A common cause of uncertainty is where there is no real understanding of the underlying physical principles. In these cases, the design method emphasises the concept of systematic test. to gain sufficient information to ensure design decisions are soundly based.

The broad thrust of the design method, its particular elements and its pivotal, disciplined role in the creative, synthetic profession of engineering can in overview be described as follows:
**Identify**

Who needs this technology and why?

Form requirements specifications; qualitative desires for what the prospective technology should do.

Identify the constraints on any solution - time, budget, resources such as test instruments needed.

**Imagine**

Determine the current ‘state of the art’.

Examine possible solutions to the problem

**Decide**

Choose the solution that meets the constraints and best meets the requirements.

**Create**

Undertake the detailed design in a top-down approach

Design for test and manufacture

Operational design; reliability, maintainability, usability, serviceability, disposal

Design can be described as a process for translating a ‘black box’ - black because it is unknown - into an artefact. Requirements specifications define the black box and establish what a solution looks like; its form and behaviour. In your case, most of the requirements should be well-defined unlike in an industrial situation. If not, you will have to frame priorities.
Requirements specifications cover both features expected of a solution and constraints that apply to any potential solution. The obvious constraint is the time to complete the activity. However, other resources are subject to constraint. For example, you may not know very much about how to design a given element that looks like being part of every solution, or you may need a specialized test instrument that may not be readily available. If you are buying in components, then think of the time it will take to acquire them.

Before you exercise your creativity, there is another step to follow. Henry Ford commented that he was all in favour of working hard but didn’t think much of hard work. In this context, it means learning from the experience of others. An essential step is to identify what similar or related work has been done to solve all or part of the problem that is the core of your project. Search out papers, articles, reports, books and handbooks. How many? For an undergraduate thesis, enough for you to claim you understand the ‘state of the art’. For a masters thesis, almost all relevant work. For research degrees, it should be every source related to the topic. How do you do this? Look at key recent work, note who they are quoting and work back. Add authors to your keywords list and put all of them into a search engine.

You need to carefully evaluate each of these contributions and record that in your project logbook. Record the authors, title, location and a few keywords, and then summarise the paper under some key headings of interest to you.
For example, what theoretical work was produced or used? Who is quoted? What results were achieved? What comments do they make on alternative approaches or future directions? What are the advantages and disadvantages of the approach used? With what authority do they communicate? What is positive, negative or just interesting about this work?

The imagine phase of design is conceptual and creative. Several abstract designs are sketched subject to the constraints, but providing the desired features. Do note there is NEVER one solution to an engineering problem; there are more than 10 possible designs for electronic oscillators. However, there is often a best solution.

Eventually a decision has to be made on which is the best solution. You should be looking to decide amongst at least three possible solutions. A vitally important step here is when you do decide which is the best, record your reasons why. This need to be part of your thesis.

To emphasise again, you should just have a concept at this point. To illustrate, your project may be the design of a rear sensor for a car. Then in your reading and analysis, you have decided the best option is to issue a modulated acoustic pulse and then detect it with a band-pass filter. Your analysis shows this will reduce the impact of ambient sound. In demodulating, you can detect through the Doppler shift of the rear object is
moving or not and that increases safety. You have also decided to detect the pulse waveform and integrate it as that will overcome any distortions. In short, you have decided on a series of actions that will give a good result, but there is no need to say, for example, what acoustic frequency or circuits to use. Nevertheless, you should have some idea of what is possible and what is not, the costs and so forth.

Your next step is to probably frame design specifications although this may not be necessary in all cases. Design specifications assign real numbers. Thus in the previous example, the modulating frequency, the signal to noise ratio of amplifiers, bandwidths and so on.

Once design specifications are in place, detailed design can begin. Your plan can probably be only general at this time and some additional planning may be needed later to identify details. Nevertheless, all projects must follow engineering practice and work top-down through high, medium and possibly low level design.

High level design is simply looking at the system as a whole and translating the specifications to the individual sub-systems. For example, if you were designing a very high performance audio system, then you would create a noise budget from the specifications and determine what should be the noise figure for the pre-amplifier and the power amplifier to meet that. Similarly
for total harmonic distortion. This is usually completed in quite a short time. Medium level design is looking at the sub-systems. So in this example, what form of pre-amplifier and power amplifier out of the many circuit options available. Again, this is quickly accomplished. Most effort is spent in low-level design. That is, what transistors are to be used in the power amplifier, what are the actual circuit values and so on.

In broad terms, your project plan will almost certainly need to address the following:

1. **Design**

   To be more general, this is whatever forms the core of your project work. Recall that what you are doing here is demonstrating your potential and ability. Consequently, recording what you do is important. That is to say, recording your intellectual activity - the critical decisions you are making - is important as you need to write those up for a thesis. Please note you are not developing a product. If you were you would need to consider issues such as reliability, maintainability, ease of manufacture and so forth as well as packaging. What you are essentially doing is ‘proof of concept’; showing some idea does seem feasible. If that involves creating an artifact, then at best that can be described as a prototype.
2. **Implementation**

An important part of the project is verifying that your design meets requirements. That can be done by simulation or by constructing a prototype and testing it. Some comments on this:

i. Time spent in solving problems at the design stage is at least 20% of that in solving problems in the debugging stage.

ii. The idea your implementation will work first time could almost be said to violate a fundamental law of nature. Therefore, evaluate how you will test sub-systems; what inputs to apply, how to generate them, how to measure the outputs in response to those inputs and what outputs are expected if the system is functioning normally. Note one of the many meanings of the acronym DFT is design for test.

iii If testing is essential, then it is fair to assume modification of the design will occur. The implementation should therefore permit easy modification and that implies paying close attention to how the design will be created.

3. **Verification**

In many respects, the most important part of a thesis is not the design development, but the verification process outlined to show that the design meets requirements. Failure in an engineering context does not necessarily mean failure to function but it does mean a failure to meet specifications. Thus verification is an
intrinsic and critical part of the overall design. The thesis must
detail the test procedures employed, which must conform to
accepted standards, plus the test result showing all claims made
are justifiable. Note you may be asked to demonstrate that
verification process to your Supervisor and others.

4. *Modification*

Just because a design needs to be modified does not imply failure;
most designs require modification for a host of reasons. Therefore,
how modification was tackled is important to demonstrate your
professional skill. Highlight how you identified what modification
was needed, how you implemented it and the subsequent tests
completed to verify the modification achieved the desired result.
The points to stress are the maturity of your approach and the
systematic way in which you tackled the problem.

5. *Writing the thesis*

This major activity needs careful planning in its own right. A later
chapter is devoted to this.

Your plan in most cases may be summarized by a **Gantt chart.** Identify the
key **milestones** of your project on it. Particularly important, identify what
you will achieve - and that you can **demonstrate** what you have achieved - at
the end of the first semester. It is important because it relates to assessment.
3.3 Time allocation

Allocating time to the different sectors of the project is critical. Time is very limited. You have other commitments, each semester is 12 weeks and the mid-semester break allows only around 3 weeks work! A crude rule of thumb; for each hour of design, assume one and a half or two hours in fabrication (be this construction or programming) and three to five hours in debugging and testing.

Consider the second project unit. You have to create a poster and write a thesis. Consider the latter. Try this simple exercise. Write or type a one page summary of any chapter of a textbook. In general, this will probably take about half an hour per page. If you have to check references, a little longer. Taking a thesis of about 80 pages, then that is at least 40 hours just to produce a draft. Therefore, a reasonable allocation of time for the thesis is:

1. writing the thesis and editing it 5 weeks
2. draft review by Supervisor 1 week
3. correction of the draft 1 week
4. final production of the draft, including drawings 1 week

8 weeks

This is two thirds of the semester and so far no consideration has been given to the poster or your other commitments. How many nights per week and how many weekends are you prepared to commit?
Some guidelines on creating a plan for writing the thesis:

1. Note your academic commitments including examination periods, likely assignment due dates and so forth. These mainly occur towards the end of the semester, so commit heavily to project at the beginning of the semester.

2. Find out the delivery times of components you plan to use. This needs to be taken into account when planning.

3. Do not scrimp on the time needed to write the thesis as its presentation and the information within it plays a large part in your final assessment.

A critical mistake many students make is to assume they can ‘catch up’ in the mid-semester break. Two problems with this. First, you are assessed on your first semester’s work. Indeed, on what your plan said you were going to achieve. Second, there is not nearly as much time in that break as you might think. Bank on the mid-semester break only as a time just to finish off as it is now is quite short – about three weeks from the end of exams to the beginning of the next semester.

3.4 Changes to the project plan

In engineering practice, once a project plan is created then it must be rigidly followed to prevent overruns, cost blowouts and possibly penalties of various kinds. However, there are always problems such as particular
components are unavailable or delivered late, unforeseen events occur, sudden staff changes take place, equipment fails or is unavailable, and so forth. Project management emphasises regular reviews of the plan.

If the evidence found in a review suggests it is necessary, then a change to the plan is initiated. This is a deliberate, carefully considered activity as there are several implications of any change and they must be considered. Clearly, one of those is whether the requirements can still be met, but just as important is the cost of the change, the impact on timing and the resource implications. There are numerous examples of how this wasn’t done and the consequences. The Sydney Opera House was planned to take 3 years to build and cost $17 million, but due to frequent changes, political interference, change of contractors, etc, it eventually took 12 years to build and cost about $300 million. It isn’t very difficult finding similar examples elsewhere.

You need to follow the same process of careful change. **YOU MAY NOT CHANGE THE PLAN AT WILL.** One reason you need to meet regularly with your supervisor is so both of you can review progress. If as a result of that it seems necessary to change your plan, then:

1. identify a change that ensures the project is still viable as a demonstration of your potential and abilities;
2. assess the implications of that change in terms of resources.
You need to make a dated, written submission with signed cover sheet from your supervisor to the Projects Coordinator.

Changing a plan should be seen as an important part of your project work. It is very unlikely any plan will remain static. Changing your plan is quite normal. Further, your reasoning and approach to remedial action is another opportunity to demonstrate your potential and ability.

3.5 The project logbook

A project logbook **MUST** be kept and presented at each meeting with your supervisor. Further, it is now an assessment requirement it **must** be submitted with your thesis. The contents of the logbook **must** include:

1. your project plan and amendments;
2. information which needs to be reported in the project report;
3. a list of meetings held with your supervisor and signed to verify the meeting was held
4. clear evidence of the systematic development of the project where this includes weekly reports of progress, designs, tests, etc;
5. full details of the reasoning behind designs or tests;
6. full details of test procedures as well as the results of tests.

A loose-leaf folder is often useful as it is easier to include photocopied articles.
3.6 Your project Supervisor and your plan

Your prospective Supervisor will have very clear idea of what is required of your project – unless you nominated it. They will also usually know what can be achieved, what has been done in the past and what problems may be encountered. Consequently, getting started on planning means meeting with your prospective Supervisor to discuss the project and define the requirements specifications.

Your Supervisor, though, is not going to prepare a plan for you. Their role at this stage is to advise, to review what you have done, comment on your reasoning and so forth. The plan is and must be your own effort. It demonstrates your ability and figures in assessment.

3.7 Summary

Why a plan

Identifies how to use your time most effectively – a Gantt chart

Managing the plan

Create before starting work

Review regularly

Upgrade as necessary BUT you must gain your supervisor’s approval for any changes

Creating a plan

Identify constraints
Academic – exams, assignments.

Labs – availability

Time

Components, test equipment, software, etc

Identify key actions to reach the project goals

Specify – what do you think is needed and can be done

Investigate – what is the ‘state of the art’

Design

Options

Decide the best

Do systems, medium, low level design

Implement – build, program, simulate – verify

Write the thesis

Determine reasonable time that can be spent on each section

Allocate time within them for sub-activities, subject to approaches you can follow

Record your decisions as you execute the plan

Have a logbook

Your supervisor and your plan

Its there to guide; its YOUR plan
4.0 EXECUTING THE PROJECT PLAN

4.1 Introduction

Execution of the project means working through each stage of the Project Plan, culminating in the preparation of the thesis. This sounds simple, and it should be, but there can be many frustrations. Many are predictable but good planning will minimise their impact. Others are not. A commonsense approach, though, can reduce these to minor annoyances.

Please note again that a project plan is created before you start and you MUST file a copy of that plan with the Projects Coordinator. Further, you may NOT change your plan at will, but follow the change procedure.

4.2 The role of your Supervisor

Your Supervisor:

1. assists you in formulating a Project plan;
2. guides you in the execution of your plan;
3. approves all expenditures;
4. assists you in accessing the resources you may require;
5. offers technical advice;
6. reviews the draft thesis and corrects factual errors;
7. assesses your overall performance and make a recommendation to the Projects Coordinator on the grade to be offered.
Note that these words are *guide* and *assist*, not direct. You are not working *for* your supervisor, but *with*. To emphasise again, the objective of project work is for you to demonstrate *your* potential and abilities, and that means *you* being able to:

1. accept an outline of ideas and make them into a workable proposal;
2. show initiative;
3. take responsibility;
4. demonstrate a range of intellectual skills;
5. keep a logbook in good order.

Project is less about achieving the end point defined in your project plan, but how you reached it. That is what counts in assessment of your performance.

The relationship between you and your Supervisor can be described in many ways. It should be professional. The term often used overseas - Thesis Adviser - is extremely apt. What all this implies is that the more work you do, the more proposals you present, then the more responsive will be your Supervisor. Part of your task is to convince your Supervisor of your ability. You want to give the impression of a keen but methodical mind, a hard worker, someone who has considered every possibility and therefore someone who deserves the highest result.
You **MUST** meet regularly with your project Supervisor; at **least** once per fortnight. **You** need to organise a mutually acceptable time for these meetings as a first step in undertaking the project. It is **your** responsibility to meet with your supervisor; your supervisor will **not** seek you out. Failure to attend meetings shows a lack of a professional attitude. That is failure to meet the unit requirements. If you cannot attend a meeting, then email or phone.

4.3 The initial steps

The initial steps in executing your project are very simple. Look at your plan and start. There are only 12 weeks in the semester, thus each week lost is 8% of the total time lost. **Begin on Monday of the first week of semester.** Hence make sure you have everything you need by orientation week. That is to say:

1. your logbook;
2. ensuring you have access to laboratory space if you need it;
3. ensuring you can access software or other IT you may need;
4. checking there are no timetable changes that might impact.

4.4 Cost estimation and ordering

During your course, staff will have encouraged you to explore design and the innumerable ways of accomplishing a task. New components will have been frequently brought to your attention and new design techniques. This is vital in an engineering education. Your personal creativity must be
developed and your excitement at being an engineer and enthusiasm for your chosen field encouraged. Unfortunately, that is not real engineering.

Real design has limited freedom. It is the art of working within constraints and it requires considerable self-discipline. It is a skill to be learned and that is one of the primary objectives of the project. The primary constraints should be obvious; time and money. Regrettably it may be, but the most important symbol in engineering is $ and the most important measurement is time. The time constraint on projects has been outlined. It is what in foresight seems an age and in hindsight seems an absurdity. Financial constraint must be imposed by reality. Our resources simply do not extend to large numbers of students buying whatever they like. Thus we impose a control mechanism to ensure you will consider costs very carefully indeed.

As part of a project where you create hardware, you should:

1. include a cost analysis of each of the design alternatives;
2. include cost as a factor for selection of any of these;
3. create a parts list - covering the quantity and type of each item - and cost it - the individual components and the total cost;
4. justify the cost of your project to your Supervisor and only when your Supervisor has agreed, fill out an order form (which will need to be countersigned by your Supervisor);
5. include that costing in your project report as an appendix.
You would be wise to assume the best alternative for your project is the one involving the lowest cost. Note there are limits to expenditure. If you think you have a very good case to exceed them you can present it to your Supervisor, possibly the Projects Coordinator and Head of the Department. As part of that, you will need to present evidence that what you wish to order can be delivered on time, and for software that you will be able to use it effectively. A good case is where several students can share a package.

**PLEASE NOTE YOU MAY NOT ORDER ANY ITEM FOR A PROJECT IN THE SECOND SEMESTER UNIT.**

### 4.5 Use of the laboratories

While you are on campus, the University is legally obliged to ensure you do not come to harm. To ensure that, we must have a set of laboratory rules. Copies of the general Laboratory rules are in each laboratory and on the Department’s web site. In addition, there are some specific project rules listed below. Our laboratories are potentially hazardous, but with a little care need be no more dangerous than the Student Cafeteria.

If you deliberately damage equipment when doing project work, either maliciously or through ignorance, then the University can take action against you including legal. We do not wish to do that and we are sure you do not want it to happen. Note the paragraphs below.
You will often find in project work that you are asked to sign for things. The legal significance of this is that:

1. you are accepting responsibility for that item until some due date;
2. by your signature, you are agreeing the item is in good working order on acceptance and will be returned that way.

If it does not work when you return it, then the Department has the legal power to send you the bill for repairs. Therefore, look after anything assigned to you very carefully. (It is a very good idea to check that it is in working order.) If you lose it, we do expect you to replace it.

Legal requirements under various acts mean you cannot work in a laboratory unless a member of the University staff is present. See the Technical Services Manager to organize this. The exception is the computer laboratories. You may work in them at any time. Only academic or technical staff are permitted to turn on power and you must obey their directions at all times. Do not leave anything in a lab as loss of your personal items is not covered under the University’s insurance policy.

You cannot ‘claim’ any laboratory equipment for your personal use. If a point is reached where in the opinion of one of the academic or technical staff you are endangering the good order of the laboratories, then it may be necessary to exclude you. That also implies you have not demonstrated a proper professional attitude and so you will probably be failed.
Please note you are not permitted to install any software on a University computer.

If you work in a Laboratory, then:

1. You are not permitted to disassemble any equipment. If anything at all is wrong - even a blown fuse - then call on the technical staff.

2. It may be prejudice on our part, but we feel that the suppliers of our test equipment have a better understanding of how to design it than you. **NO** modifications are allowed such as soldering wires to contacts. To do so is a deliberate act of vandalism.

3. If you do not understand the operation of a piece of equipment, ask the technical staff for a handbook. If you still do not understand it, ask for someone to demonstrate it.

4. Equipment must not be moved from one area to another without the express permission of a technical staff member. If agreed, your name and the unit will be entered into a loan book and you must sign it and take responsibility for its safe return to that area.

5. As a general rule, technical staff will not nor should they be expected to assist in the construction of the project. If a particularly difficult problem does arise which may call for some intervention, such as precision mechanical work, then outline your needs to your Supervisor.

6. Scheduled classes naturally take precedence for the use of labs.
If you do not wish to work in the department’s laboratories:

1. We cannot make equipment available for you to take home. For an industry project, the organisation may be able to rent equipment if they wish.

2. Regardless of where you perform the project work, you will be required to demonstrate the result to your Supervisor. That may mean using the Department’s facilities in some way so check if we have what you need.

4.6 Some general comments on construction

Some miscellaneous comments are in order concerning particular aspects of project construction work. Clearly, they do not apply to all students. Then:

* Printed circuit boards will not be produced for electronic projects unless specifically requested by your Supervisor.

* You are encouraged to do your own mechanical work. Otherwise, your supervisor will need to arrange it.

* Please do not package your project, as your supervisor will need to assess how well you have fabricated the project.

4.7 Fault analysis

It is extremely unlikely any project will work exactly as planned. That is, a verification test shows the unit will not meet the specifications laid down. Thus now the problem is to determine:
1. how it fails to meet specifications and why;
2. where in the system the problem lies;
3. how to correct it;

and then repeat the test to verify the modification succeeded.

The first part of this, in contrast to some student opinion, can be a simple, logical procedure. For example, if the test results are not what is expected, then first:

1. check the test procedure to ensure it can measure what is desired;
2. if it is a physical system, check ranges, probe impedances, instrument calibration and so forth.

If the test procedure seems satisfactory, then for a physical system check the:

1. components to ensure they are the correct ones;
2. component values;
3. constructed layout against the paper schematic.

If these obvious steps find no fault, then the problem is clearly a little more serious. So, gather information for fault detection and rectification. That is:

1. measure, record and relate to the appropriate part of the circuit all DC voltages in the system;
2. measure, record and relate all signal waveforms in the circuit when you test signal is applied at the input

Now complete the process by checking the:
1. paper design and comparing the test data against what was predicted;
2. paper circuit really is the implementation of the design.

Foremost in this process is to **record** information. In the designs, record why particular systems were chosen as well as how they are expected to work, both in general and with the specific test signals planned. In tests, record test information show exactly what the system is doing. It is preposterous to assume that the white heat of inspiration will hit within microseconds of a measurement and you will identify faults. Rather, a great deal of thought will need to be given to identifying why faults have arisen, their causes, their remedy and an effective cure. That cannot be done via memory alone.

Software fault-finding is almost identical. Here, though, it is more important to identify a set of test inputs and the values they generate at all your proposed test points before you begin the design proper. Use a modern IDE for any software development and become very familiar with its checkpoint, stepping and other debugging and checking capabilities.

There is a distinct possibility you might not be able to find the fault. Then you will need to call on others to assist. The options are your fellow students, although they are often as unskilled as you, the technical staff or your Supervisor. Now your fellow students may be very sympathetic and
prepared to tolerate almost anything. However, put yourself in the position of the staff. They have numerous things to do and very little time to do it in. There are all sorts of pressures upon them. Then up comes a student and says plaintively, “it doesn't work, can you help”. Yes, that is possible, but what was the test procedure and what were the results? Wouldn’t you get a trifle annoyed if there was no test, or results were written on a scrap of paper? Wouldn’t you think that this was someone who engineering could do without?

Engineering is not about symbols on pieces of paper. It is about real technology. That means any reporting must show the design - what it is supposed to do - with the test results showing what it really does. Again, would you buy a car because the salesperson said ‘its good’? Would you buy a PC because the dealer says ‘its better’? Would you, if you were an examiner, pass a student project in engineering, which merely said a system ‘worked’ without any proof whatsoever or enough information for you to duplicate exactly what was done?

4.8 Summary

Working through the plan

Keep your logbook up to date

See your supervisor at least once per fortnight

Your supervisor guides not directs, so take proposals to those meetings
Review your plan periodically and seek approval to update if necessary

Keep checking the resources you need will be available

A constraint

You cannot order anything in the second semester; all development must be complete by then

Using laboratories

You can only work there with permission

Don’t work alone and don’t touch power switches

You CANNOT borrow equipment so plan to use it in the lab

Do NOT install software on laboratory computers

Do NOT modify any lab equipment or attempt repairs

Construction

We cannot offer much assistance, but then this is just ‘proof of concept’.

Fault analysis

Before asking for assistance, observe, measure test and record
5.0 ASSESSMENT OF THE UNDERGRADUATE PROJECT UNITS

5.1 Introduction

There are three main forms of assessment:

- **Reflective assessment** is designed to help you understand what needs to be done. The project plan, logbook and this Guide are intended to assist in your reflection and so will the archive of past theses.

- **Formative assessment** is designed to assist you to judge progress. Regular meetings with your supervisor and your logbook, plus your seminar and thesis draft are important in this.

- **Summative assessment** determines whether you have met the unit outcomes. That is achieved by assessing your thesis, poster and logbook.

This chapter focuses on the last of these.

Assessment in project units changed in 2011 for a number of reasons. One clearly was that previous approaches had developed some problems, another was to bring projects into line with changed requirements set for accreditation by Engineers Australia and a third was to improve the quality of projects.

Project work is a little unusual in that although it is one task, for most students it is undertaken as two units. The following needs to be noted:
1. In both semesters, you first must meet a checklist of requirements before you will be assessed. If you do not meet the checklist, you automatically fail and are given a DNC result.

2. There are no supplementaries awarded in project units given they are supervised and work to a plan. There are also no deferments granted given that time management is an important outcome.

3. For the first semester, you will receive either P or F. P means that you are keeping to the plan as agreed between you and your supervisor. Therefore, your progress is satisfactory. F means it is not.

4. For the second semester, your thesis is judged against a set of broad criteria. You cannot receive a high grade merely by focusing on a particular part of the thesis.

5.2 General requirements for Projects

5.2.1 Enrolling in project units

To reiterate points made elsewhere in this guide:

1. You may not enrol in project units unless your course coordinator approves. In general, that approval is only given in an undergraduate course if you have completed the equivalent of three years in the engineering program. In rare circumstances, you may be permitted to begin project after five semesters in the engineering program or three in the Bachelor of Technology.
2. Your enrolment is treated as conditional. You must submit a registration form by week 1 of semester. Unless you have submitted a signed Patent declaration form, a copyright form and an approved project plan by the HECS cut-off date, your enrolment will be cancelled.

5.2.2 The first semester checklist

To be assessed in the first semester you must:

1. not have breached any Departmental laboratory rules or University regulations, particularly relating to copyright and IT.
2. have meet regularly with your supervisor as evidenced by a page in your project logbook with signatures showing meetings at least one per fortnight;
3. have reached the objectives stated in your most recently approved project plan;
4. have submitted your project notebook before 4.00 PM on the Friday in the last teaching week of the semester to your supervisor for inspection;
5. have reached the milestones in your plan;
6. have presented a satisfactory seminar.

If you do not satisfy any of these, then you will achieve an F grade.

5.2.3 The second semester checklist

To be assessed in the second semester, you MUST:
1. not have breached any Departmental laboratory rules of University regulations, particularly relating to copyright and IT.

2. have meet regularly with your supervisor as evidenced by a page in your project logbook with signatures showing meetings at least one per fortnight;

3. have completed your most recently approved project plan;

4. have returned all borrowed materials;

5. have presented a thesis draft and your logbook to your supervisor in accordance with requirements.

7. submitted to the Faculty Assignments Office before 4.00 PM on the Friday of the last teaching week of the semester:
   i one bound copy of your thesis in accordance with Departmental requirements;
   ii a second unbound copy in any protective folder you wish with loose documentation sheets;
   iii an electronic copy on CD with your entire thesis upon it again in accordance with Departmental regulations;

8. submit to the Projects Coordinator via email before 4.00 PM on the Friday of the last teaching week of the semester an A1 poster as a pdf document.

NOTE; all theses will be checked to ensure they meet the standards described in this Guide. If not, it will be returned to you for correction and you will be penalized.
5.3 Patents and Copyright

Since you are using University property in working on your project and as you are under the guidance of a University employee, then anything you develop that may become a patent or registered design is the property of the University. You must sign a declaration accepting that and submit it to the Projects Coordinator before the HECS cut-off date or your enrolment will be cancelled. The only exception to this is for those students who have an approved industry project. In that case, what is decided between you and that organisation over these issues is entirely your affair.

Needless to say, patents are hardly an issue in undergraduate projects. In fact, the Department has never had one issued to a student. However, it is a legal requirement that you sign the Patent agreement before you commence the project. Legally, if you do not and then later file for a patent, you are in breach of the law and the University can sue for all the proceeds you gain. You will, of course, also have to pay your own legal fees and in patent cases they can be high.

Your project thesis shows the state of development you reached. You can proceed to further develop the idea either on your own or with industry support after graduation. You are strongly advised to ensure your records show a clear separation between these later activities and your student days if you think a patent is likely.
If you do believe you have developed a patentable idea, then what do you do? The first step is to ensure that it is patentable. Some brief comments.

Patents and copyright are both measures to provide protection for intellectual property (IP), but quite different in their thrust and utility. Copyright largely applies to a given instance of something. For example, a musical composition, a piece of literature, a particular graphic used in advertising, a painting or your thesis. You copyright that particular instance as it is important, and clearly changing the sequence of notes or the words, or re-arranging the graphics largely creates something very different. The law actually specifies how different something must be for you to be in breach of copyright to ensure any change you make to try and avoid the original holder’s IP is defeated. Because it is an instance, there is no registration process in copyright (but there is for trademarks).

Copyright also applies to graphics such as house plans and schematics. However, what is important for a schematic is not the drawing itself, but the intellectual process you went through to arrive at it. It is your approach that is the IP, not the end result. This is where patent law applies. A patent is a legal agreement with the state. In return for you disclosing how you achieved some useful end, the state gives you a monopoly for a fixed time to exploit your invention. There are two types of patent; innovative and full. Innovative apply for a shorter time and can be described as between a full patent and copyright. Comments here relate to full patents.
A patent gives you exclusive rights to produce an invention, sell it, licence it or whatever. If for reasons beyond your control you were unable to exploit your invention effectively and so gained little, then you can seek an extension of the patent licence period. Sir Frank Whittle, inventor of the jet engine, did this as World War II limited his opportunities.

A patent has to express novelty. To use legal parlance, it cannot form part of the common knowledge. That means a typical skilled practitioner who could implement your invention would not be aware of what you have proposed and would not have followed your course of action in their duties. An implication of this is that the invention cannot be described in part or in full in any publication such a skilled practitioner would be likely to read prior to filing the patent. Hence the importance of undertaking an extensive literature search when filing a patent.

The awarding of a patent simply means the patent application meets legal requirements. It does not mean the government believes the invention is useful or that it can be created or indeed is unique. Only one type of patent application is automatically rejected – for any form of perpetual motion machine – and others if rejected are done so purely for legal reasons. Once letters patent are awarded, they can only be rescinded if a court declares the patent to be invalid. Patents are listed in a gazette prior to the letters being issued and at that time objections can be raised.
The protection patents offer is often overrated. It is quite easy to circumvent many of them or prove they are invalid. In rapidly changing areas like electronics, patents are most valuable for fundamental processes such as semiconductor manufacture. Nevertheless, a patent holder can cause considerable damage to an organisation before a final ruling is made on infringement or whatever.

If you believe you have a patentable idea, your proposal must be submitted to the University’s Patent committee who will decide whether to proceed or not. If not, then you may proceed independently. If the University does pursue the patent, then you will be given a royalty of between one and two thirds of all proceeds raised after costs and the University pays all costs. There is no imposition or unfairness here. The University pays far more of the royalties to you than is common in industry. There, you might get a Xmas bonus and first choice at the plum projects, but that is usually all. Mostly what you get is prestige.

Paying for your own components does not mean you gain patent rights. The key legal condition is that University resources were used to generate the patent, which means space, equipment and consultation with staff. Thus paying for your own components simply means you may keep the physical project.
Avoiding these patent requirements is only possible if you do an industry project. A ruling by Council has declared the University waives all of its rights in this regard.

In the case of research graduate research theses, there is technically no such thing as an external project. Equally, because it is more likely such a thesis would produce a patent, the University is more strict in its approach. It is now standard throughout Australia that any patents produced by research students belong to their University.

Legally, you have copyright of your thesis as you produced the document. However, you have submitted it to the University as a course requirement thus you are effectively assigning the University the right to copy as often as it desires for non-commercial purposes. Part of what the latter means is that if you believe you can produce a book from your thesis, then you may proceed and the University will make no claim against you. Please do NOT mark your thesis ‘copyright’. That has no legal force or meaning. Equally, do not place company logos or so forth on it.

5.4 Public disclosure

We wish to use theses as an example of our education process and the work undertaken. However, there are some issues of copyright to consider and as a result of that, we require you to sign a copyright release form.
The electronic versions of theses are available on our servers. However, only students logged in on campus can see the entire thesis. Others can only see the thesis abstract. If they want to read a copy of the thesis, they need to contact us and we will provide that with the marking sheets and letter to the HOD removed if we accept their reasons.

If the project is sponsored, then a problem can arise as discussed in section 2.4. While we will agree to hold back a thesis for a time, it is only for enough time for a company to seek a provisional patent or complete development. In these cases we will not accept any thesis stamped with ‘Confidential’, ‘Commercial In Confidence’ or any commercial trademarks. Apart from the fact they make the thesis non-standard and so unacceptable, those provisions have no legal force and will not be accepted. Similarly, any restrictions on distribution will not be accepted. Unless a company issues a formal request for some waiver to the Department before the project begins, it is taken they are in full agreement with the Department’s policies with regard to projects.

5.5 Assessment in the first semester unit

Assessment in the first semester unit has changed for 2012 onwards. You will give a seminar on your project and the panel will make a decision on whether it believes satisfactory progress has been made or not. The Projects Coordinator as the unit controller and so ultimately responsible for results then ratifies that result.
5.6 Assessment in the second semester unit

5.6.1 Introduction

Assessment in the second semester unit of project is based on the following:

1. You must meet a checklist of requirements.
2. If you do, then a grade will be determined where:
   
   15% of this is derived from your poster and logbook
   85% is derived from your thesis

Both your thesis and seminar are graded according to broad criteria derived from the AVCC (Australian Vice Chancellor’s Committee) recommended criteria for assessment.

Your thesis is examined by your supervisor and ratified by another person who has some understanding of what you did. Usually, that is a member of the academic staff but it can in some circumstances be an external person or a visitor to the Department. The final result is determined by the Projects Coordinator based on an assessment sheet supplied by the examiners.

5.6.2 The poster and logbook

From 2012 onwards, you are required to submit a poster and your logbook in the second semester, and both will be assessed by your supervisor and one other. The poster can receive up to 5 marks; the logbook 10.
The logbook is assessed on its professional qualities. That is to say, is it a record of a systematic development of the project and contains all relevant information.

The poster requirements are as follows:

* It is to be a summary of the thesis and the achievements of the project on an A1 sheet.

* The top of the poster is to have the thesis title and your name.

5.6.3. Assessment of the thesis

Supervisors – who are one of the examiners – are asked to assess an undergraduate thesis under several categories. First, they are asked to comment on some questions:

Is this thesis eligible for a prize or could it be published?

Has the student presented a draft?

Has the student kept in regular contact?

Has the student kept to the plan and has it changed much?

Then they are asked to rank the thesis on a scale of Poor, Below Average, Average, Above Average, Excellent in the following categories:

What does this thesis suggest is the potential of the student as an engineer?

Taken as a whole, how does this thesis rank in its intellectual content as a problem-solving exercise?

Are the sections of the thesis of equal quality?
How well does this thesis describe the ‘state of the art’?

How relevant are the techniques used to solve the problem?

How well have the outcomes of the thesis been communicated?

What is the quality of the solution compared to currently accepted practice?

How well has the solution been verified?

What is the quality of the conclusions drawn and the recommendations given for future development?

Coursework masters theses are assessed in a similar way, but a higher standard of work is expected.

Normally the examiner and co-examiner mark independently; that is why we ask for two copies of the thesis. They then meet and decide a final result. If their results are significantly different, or if one of them or the Projects Coordinator raises some concerns, then a third examiner may be employed. This third examiner will be completely independent of the project.

5.7 Completion

Your notebook and second thesis copy may be collected after the Board of Examiners meets ( held sometime in July and December each year ). If you do not, then after six months they will be discarded. If you fail the project, then your project report is returned to you. If you decide to abandon it, then the Department would normally dispose of it after six months.
At present, the bound copy of your thesis is kept within the Department for approximately ten years. Due to issues with storage, they are then destroyed. The electronic version is placed on a server and is available over the Department’s network. An archival record is also made of all theses and so these will be available for the foreseeable future.

Your supervisor may ask for a copy of your thesis. This is a private arrangement, not a requirement. If you agree, usually your second copy is retained by your supervisor.

5.8 Research graduate theses

Graduate research theses have a much more elaborate assessment procedure controlled by the University’s Graduate Studies Committee. A graduate student has a thesis committee with usually has three members of staff upon it, including your Supervisor. Its role is to review progress and supervise assessment. There are two examiners.

One examiner is usually external to ensure the thesis reaches national and international standards. Their reports are sent to your thesis committee who then make a recommendation to the graduate committee. It may be necessary in some circumstances to appoint an additional examiner. The recommendation will usually be pass or fail, but passing may be conditional on some re-writing of the thesis or other changes. Expect that it will take up to six months from when you submit before a result is available.
5.9 Summary

General issues on assessment

A checklist of requirements must be met before assessment occurs

No supplementaries are offered as project is planned, supervised work.

No deferments are allowed as time management is an important outcome.

First semester assessment is either P or F. P meaning work is satisfactory and keeping to plan, or it is not.

Second semester assessment involves a poster, the logbook and a thesis.

The latter is assessed holistically.

Enrolling in project units

You may not enrol in project units unless your course coordinator approves.

Your enrolment is conditional until a project registration form, Patent declaration form, copyright form and a plan is submitted

The first semester checklist

No breach of any Departmental laboratory rules or regulations of the University, particularly relating to copyright and IT.

You must have meet at least fortnightly with your supervisor.

You must have completed the milestones outlined for the semester in your most recently approved project plan.

You must have submitted your project notebook to your supervisor for review before 4.00 PM on the Friday of the last teaching week.

You must have given a satisfactory seminar on your project.
The second semester checklist

No breach of any Departmental laboratory rules or regulations of the University, particularly relating to copyright and IT.

You **MUST** have presented a draft and your logbook to your supervisor

You must submit to the Faculty Assignments Office before 4.00 PM on the Friday of the last teaching week of the semester:

i. one bound copy of your thesis in accordance with requirements;

ii. an unbound copy with loose documentation sheets;

iii. an electronic copy on a CD of your *entire* thesis;

You must have submitted before 4.00 PM on the Friday of the last teaching week of the semester a poster in the form of a pdf document to the Projects Coordinator

**Checking theses**

All theses will be checked by the projects coordinator. Any rejected for not meeting requirements will be penalised.

**Copyright**

You own the copyright to your thesis, but we require a release so we can place it on our servers.

**Public disclosure**

Only by *prior* agreement will an industry project be withheld from public disclosure and then at most for three semesters.

Outside of the campus, only your thesis abstract can be seen.
Assessment in the second semester unit

A grade is awarded; 10% due to the logbook, 5% due to the poster and 85% for the thesis.

The thesis assessed holistically. That is, examiners are asked to grade the thesis according to broad criteria.

Assessment is by the supervisor and co-supervisor (or another member of staff familiar with the area) with the projects coordinator acting as moderator.
6.0 THE FIRST SEMESTER SEMINAR

6.1 Introduction

As of 2012, the seminar component of project has been moved from second semester to first semester. Further, its thrust has changed. The seminar:

1. will give you the opportunity to give an oral presentation to your peers, members of the academic staff and others who are interested on your project topic of your progress;
2. be supported by a Powerpoint slide presentation;

It will decide the assessment for the first semester of project work. Thus:

1. you will outline what you have accomplished so far, and what you expect to accomplish before writing your thesis;
2. if you convince a panel of three assessors that you have kept to your plan and the project is worthwhile, then you pass the unit;
3. you may be offered advice by the panel or others on how to improve aspects of your project.

Your seminar will be scheduled in the study week of the semester:

1. The list of seminars and the day in which they will be given will be issued about a week before the event.
2. The assessment panel will consist of your supervisor as chair, one member of staff from the same discipline area and a second member of staff from another area.
3. Each seminar session normally has eight speakers.
4. Each speaker has 15 minutes to present. This is strictly enforced. There are up to 5 minutes of question time and five minutes for changeover.

5. Students who are working on different aspects of the one problem can be grouped together. In this case, 5 minutes may be allocated for one person to present an overview so that the actual seminars may focus on the topic of concern.

6. It would be best to load your presentation on a USB stub or CD. You may bring your own laptop.

6.2 Creating your multimedia presentation

Begin work on your seminar by creating a multimedia presentation. This will support your oral presentation and it will largely be the focus of your audience’s attention. It needs to be carefully designed and prepared. It is expected this will be a Powerpoint slide presentation, but you are not obliged to do so. There are circumstances where you may choose to use an entirely different approach. It is up to you to decide how to maximize the effectiveness of the time available.

The first part of your presentation must be a slide giving:

1. the title of your project – the expected title of your thesis;

2. your name and student ID;

3. your supervisor, and co-supervisor if you have one;
4. If this is an industry sponsored project, the organization supervising you.

You need to put this up while you are preparing. The chair of the session will tell you when to begin your address.

Your will often find it much easier to give your oral presentation if your second slide is a summary of the key points of your presentation. Similarly, your last slide can simply be ‘the end’ or ‘any questions’. The rest needs to be divided into three parts:

1. What was the problem you set out to solve?
2. How have you gone about solving that problem?
3. What has been achieved and what do you expect to be achieved?

Given that you only have 15 minutes to speak, each of these needs to be covered in about 5 minutes. Thus your seminar is a very broad overview.

Some comments on creating a presentation:

1. Remember that your audience is going to look at your slides first, then listen to what you have to say. That has two implications:
   i. Each slide needs to be simple; no more than three sentences. Use pictures wherever possible as they are easily absorbed.
   ii. Keep the number of slides to a minimum. Anything beyond one slide per minute is ‘busy’. That means your entire presentation reduces to 45 sentences.
2. The problem with a seminar is not what to include, but what to omit. You do not have time to discuss everything, only what you see as necessary in order to pass the unit.

3. Some technical issues:
   
i. Remember that your slides will be projected in a darkened lecture theatre. That means it is generally best if you use dark colours for fonts and light for backgrounds.
   
   ii. As we have no control over the colour calibration of the projector, do not rely on subtle variations of colour to transmit information. This also means a pastel background will probably be washed out.

   iii. In general, a serif font is best for sentences as it increases legibility. That is a font like that used in this text with the end-caps on letters like “I”. Headings can be a sans serif like Helvetica. Fonts in general need to be quite legible and that tends to favour fonts like Times, Arial, Bookman and Geneva.

   iv. If you embed an animation, or video sequence, do not assume it will necessarily run on our systems. Or for that matter, to run well. Our machines may not be as recent as yours, and they may not have the same software installed.

   v. You can scan a document such as a drawing, but think what this will be like when projected.
6.3 Creating your oral address

Having created your multimedia presentation, you have created the structure of your oral address. Some points:

1. **PLEASE NOTE THE LATER SECTION ON ASSESSMENT.**

2. Put down in bullet form any extra issues you want to raise. You might like to use Powerpoints notes page feature for this.

3. Practice speaking on what you want to say until the timing is correct. Remember, you have NO MORE than 15 minutes. You WILL be cut-off if you exceed that time, and that can have a quite devastating effect,

4. **DO NOT READ FROM NOTES.** Remember this is an oral presentation in which you are being judged on your oral communication skills. To simply read from notes defeats that,

5. The great dangers in giving the address:

   i. Because of nervous energy, time may seem to be a lot greater than it actually is. Thus there is the danger of ‘ad-libbing’ and then running out of time,

   ii. Take your watch off or bring a clock and make sure you keep to your time. Thus you need ‘markers’ in your address.

   iii. A problem many people have is simply finishing. They feel they have to keep talking or explaining. Determine a simple ending and stick with it.
iv. Don’t apologise. The presentations are brief, but one of the reasons for that is to test your ability to concisely summarise what you have done. Simply present.

v. Plan that things can go wrong and so determine a plan B. In particular, Murphy’s law suggests that if the video worked on your machine then ours, it could well fail on the day. So, if you really need that video, what are you going to do if it fails to run?
7.0 WRITING THE THESIS

7.1 Introduction

There are four pivotal questions regarding theses:

1. What is a thesis?
2. What purpose does it serve?
3. For whom is it written?
4. How should it be written?

The first question must be addressed. A thesis is not an elaborate laboratory report, a technical report, a written tutorial, an essay or similar literary creation. It is a particular written communication with its own unique format, both physical and logical. Like these other forms it needs to be in clear, grammatical English. It reports work done and since it is reporting completed actions then it is mainly written in the past tense. It is also a communication that focusses on intellectual issues. That is, the reasoning behind various decisions made. Indeed, it can be viewed as a justification of the decisions made. This tends to it something of a dull read, but then it is a document intended to be carefully studied.

The purpose of a thesis from your viewpoint is very clear; it is an instrument of assessment. That is to say, it is the means by which you demonstrate how well you have met the project unit objectives.
From your supervisor’s and the Department’s viewpoint, it demonstrates the quality of work graduates of your course are capable of achieving. Thus theses are evidence to submit to visitors to the University and to accreditation panels.

Two other groups have an interest in your thesis.

Students following you will want to know what you did, why, what did you achieve and what are you recommending as they may be undertaking a further development of the problem you tackled. They also of course, want to know what is expected of them, so they wish to identify what they think were the keys to your success.

The second group may not be apparent to you at first. The objective of the project unit is to demonstrate your capability. That is something an employer is interested in. Academic records are all very well, but an employer does not know the units or the assessment policy and that makes it very hard to compare students from different institutions. However, every university in Australia - and indeed the world - has project in the final years of engineering programs. Reading your thesis will say a great deal about your ability - and especially qualities like initiative - and it is in terms industry understands very well. Further, it is very easy to make a comparison of theses from different universities. The only thing a thesis does not confirm is your personal qualities and that is why there is an interview.
Always take a very good copy of your thesis, properly bound by an accomplished book binder, to interviews as well as a CD to leave with them.

For whom is the thesis written? First and foremost, for your examiners as it is primarily an instrument of assessment. However, there are other readers. You need to take their needs into account to some degree, but the focus must be your examiners.

Who are they? They are expert or at least quite knowledgeable about your project topic. This has several implications. You do not explain nor do you attempt to ‘guide’ the reader. What you do is justify your actions and so you write on that basis. That means you write in the third person; do not use the royal ‘we’. Recognise that all opinions expressed are assumed to be yours unless you specifically reference someone else’s written work.

For a graduate thesis, you largely ignore the secondary audience. However, you need to ensure that your referencing is such that any reader who is confused or uncertain about anything you say can, with a bit of effort on their part, locate information to satisfy them. For an undergraduate thesis, you are allowed a little more leeway and under certain conditions you may put in some semi-tutorial material. This is discussed ahead. However, this is still a thesis and the operative word here is ‘little’.
Writing a thesis may seem a quite daunting task, especially when you note the detail contained in this chapter. For various reasons, many students find this one of the more difficult parts of the entire project. It shouldn’t be. The format is prescribed and in this day of spell and grammar checkers, you have plenty of aids to assist. All it really should be is time consuming.

7.2 Another view of a thesis

Recall that the primary audience to address in writing your thesis is your examiners. You need to communicate what you did in full and your interest is to do so in such a way as to gain the best possible assessment. So what is the examiner interested in? The details of assessment are given later, but this does not describe the process of assessment. Let us consider, then, how an examiner is likely to approach reading a thesis and so how they reach a conclusion on the result. Now of the two examiners, one is your supervisor and the other is an independent person who may know you, but not your project. This is the person we need to consider here.

This person will have been asked to examine because they have some background in the subject topic of your thesis. However, they are probably examining out of a sense of duty rather than enthusiasm for what you might have done. They are given your thesis at a busy time of the semester, they know reading it is going to take at least an afternoon and it is probable they are not looking forward to it. Remember that.
The first thing anyone sees of a thesis is the title on the front. This one sentence is vital; it needs to state in overall terms exactly what this thesis is about. Thus that title needs to include your principal keyword.

On opening the thesis the reader will see the synopsis or abstract; a paragraph that extends the title giving more details on what the thesis is about and including all the other keywords. (Note it is one paragraph; it is not a summary nor is it a discussion.) The synopsis needs to draw the reader in, to titillate them and get them interested in the good things to come. Remember, too, your secondary audience. If your thesis title is, say, “Design of a low noise amplifier” then the topic is clear. Someone wishing to know something of that wants the synopsis to state how low noise, for what purpose, what bandwidth and so on. That is, an answer to the question “does this thesis have information of interest to me”. Note that your title and synopsis need to focus on your solution; what you set out to achieve.

Moving on, the next text the reader wishes to encounter is the thesis index. Again a vital element. Why? The obvious answer is so that readers can locate the parts of the thesis of interest to them. However, consider its significance for the examiner – and a first time reader. It consists of one line summaries - the headings - of each section in the body of the thesis and so is a summary of the entire thesis. It shows what you consider the major points of your work. Thus the index needs to create an impression of thoroughness and organisation. Carefully craft those section headings so they do this.
The index is critical to all theses, but for the moment just consider how important it is in a graduate research thesis. Here, the thesis examiner is usually external. They are a busy person, they get very little reward for examining and indeed their only interest is whether the research reports something of value they may be able to use in their own work. As they are expert in their field, they know what you should be writing about. What do you think are the chances of two theses when one just has nondescript one word headings and the other has sentences showing all problems that should have been tackled were and all issues are properly surveyed?

Incidentally, a very broad answer to the question of how to write a thesis is to create a set of keywords, write the title, write the synopsis, create an index and then under the index headings, list in bullet form the key points to write on. That is a very good way of ensuring balance.

As will be explained later, an examiner expects to find in a thesis is a set of chapters with a variety of titles that he or she could interpret as meaning:

- Introduction
- Background to the problem
- Detailed problem statement
- Detailed problem solution
- Verification of the proposed solution
- Conclusions
Once into reading the thesis proper, the examiner begins with the Introduction chapter. The synopsis will have told the examiner what the thesis is broadly about, thus the introduction must expand on this. Three sections are expected:

1. The first section should set the scene as it were and justify why this problem needed to be solved. Any project examines one very small part of a larger problem, thus that larger problem needs to be mentioned. What an examiner expects to see is a set of arguments something along the lines of:

   communications is a rapidly growing industry
   an important implementation means is optical fibres
   a problem with fibres is joining them
   what is needed is a test unit to easily verify joins
   this thesis discusses a test unit to verify joins

   Note this. Setting the ‘big picture’ and then slowing moving down to the specific topic. Thus you have justified that there is an important general problem to solve and, having established that, which of the specific problems associated with that general problem is the topic of this report.

2. Your thesis is an intellectual endeavour. Therefore, in the second section you need to discuss (briefly) what you see as your significant achievements. You are hinting to the examiner of the good things that await. You are selling your work and arousing the reader’s interest in the chapters that follow.
3. The index certainly defines the structure of the thesis, but it is a little terse. Thus the third part of the Introduction usually expands on the layout. This is not a repeat of the index; rather, a few sentences are used to describe the basic contents of each of the chapters.

Do note that an Introduction is just that. It introduces. There is a fine line between a summary and an introduction and, for that matter, an overview.

The examiner will move on to the background chapter. The important point to make about this chapter; **it is not a tutorial.** The examiner understands the field; what he or she is looking for is evidence you do as well. **You** need to demonstrate in this chapter that **you** understand current practice and ideas defined in the literature. Thus it is a **justification** not an explanation. Why, because how can you claim your solution is ‘best’ if you do not understand appropriate concepts and all the options the profession has been exploring? You have to communicate that the solution you later introduce is valid because it is based on the best current understanding of the problem.

An important point to make on this. Many students feel it is necessary to write pages on every topic associated with the project. **NO IT IS NOT.** Most you can simply reference – that shows you are aware of them. The focus of this chapter should be on those elements important to the solution you are proposing, what **you** understand is important about them and so what influenced your thinking on arriving at a solution.
In an undergraduate or coursework masters thesis, this chapter should show you have read widely on the topic and reviewed all possible avenues to a solution. That means the reference list is effectively an extension of this chapter. Care needs to be shown in compiling that list and also in referencing it. Nothing is more painful than a thesis where the references are clearly an afterthought, are not the major references on the subject or are largely inaccessible. References are evidence for the views expressed. Use them in that way to back your arguments.

Background does not have to be one chapter. There are projects where the background may have two – or more – significant elements and so a structure of two or more chapters is appropriate. This is especially so at the graduate level. Also, do NOT call it ‘background’. Address the problem! Call it ‘some theoretical approaches to the design of power invertors’ or such like to convey what it discusses and link it to the solution.

While you may think the examiner will simply move on to the next chapter at this point, most will now go straight to the conclusions chapter. Why? The examiner is expert in the area, thus everything in the intervening chapters should be fairly obvious to them and the only question is whether you have got it right or not. What interests the examiner at this stage is what did you achieve, your analysis of your work and your recommendations for future work? What do you think was the most significant part of your project work? What are you nominating as the most significant problem solved?
At this point, most examiners would have a good idea of what result they intend to give. The earlier chapters will now be read, largely just as a confirmation that you have the skills and abilities implied in these key chapters. In addition, of course, to check that you haven’t made any serious mistakes. Nevertheless, there are some key points to check. In particular, your test procedures and results. However, if you have not impressed the examiner by this point, then you are in serious trouble.

Graduate theses are examined in a similar fashion, but it is more exacting. A far tighter, more closely reasoned and intelligent product is expected. An undergraduate report is merely attempting to show potential and the total assessment depends on more than the thesis alone. However, for a graduate thesis assessment is directly of the thesis content and it is judged on intellectual merit as well as technical.

The first part of the Introduction must very precisely define why the topic was worth investigating. That is usually is done in a two-pronged approach. First, by showing that the general problem is of importance as outlined above. Second, by discussing possible applications of the work done and showing their significance. The second part of the Introduction must also clearly state why this is a singular piece of work.

The background is also a critical chapter in a graduate thesis. Superficially, it is similar to an undergraduate thesis, but in practice is quite different. An
undergraduate background chapter is largely a piece of reportage. However, a graduate background chapter is more a critique. What the examiner is seeking is evidence you have read the literature very carefully and broadly. You are expected to compare different approaches, commenting on their strengths, weaknesses and possible variations. Coupled with this, the examiner will look very carefully at your list of references. As an expert in the field, the examiner will be expecting to see certain recent seminal papers in the field in that bibliography. The dates of articles and the journals in which they were published will be very carefully noted and probably checked. Make doubly sure every reference is absolutely correct!

The conclusions in a graduate thesis are literally the keys to success. The examiner expects to see a very closely reasoned intellectual argument. Recommendations now are expected to define where future research should be directed and that demands considerable logical argument and interpretation of the work you have done. Very carefully work and even more carefully review this chapter.

Graduate research theses are even more stringent. The regulations for Ph.D degrees throughout the world state a thesis must be a ‘substantial and original contribution to knowledge’. Knowledge is not information. This means you must justify the problem was worth solving. There is also a requirement for originality in the solution.
A critical point to conclude this section with concerns opinion. Unless otherwise stated, everything in your thesis is taken as your opinion. No one else’s. Yours. You do not have to state “in the author’s opinion”; that is a tautology. The whole point of having references is so that you can make it clear that the opinions expressed are not just yours. You quote them to show others hold that view and through your writing, you can make it clear you either sympathise with them or not. Of course, references also show the source of other information. Note that if you do quote a reference, then you can quote literally (in which case the words must be between quotes) or you can paraphrase or summarise. If you quote literally and do not use quotes, then you are plagiarising and in the academic world, that is a form of suicide.

7.3 The hows of writing

At the risk of repetition, the practice of engineering is defining a problem, proposing specifications, proposing solutions, detailed design followed by verification. The problem here is to write a report of many pages on a complex topic in which many ideas must be explained. That follows the same principles. Before you even think about writing, follow a top-down approach to creating a structure for the thesis and plan how you are then going to write it. A recent book on technical writing devoted 100 pages to planning, 100 pages to execution of the plan and just eight pages to the actual writing. That is very reasonable.
Once, all theses were written by hand then laboriously typed. You can still do that if you wish, but you will find it much faster and cheaper to type it directly yourself. Be very careful of the spelling checker. Indeed, it is a good idea to turn it off and then carefully note at a later stage what it is recommending. A hint on checking the document. Do what book publishers do; print it out as a long, thin, column. You will be amazed how much easier it is to locate faults.

Make a plan for producing your thesis. One would be the following:

1. Write each section as outlined in your index as naturally as you like. Make sure you complete it in one sitting and cover all the items in your outline. Go and do something else, then write the next section, and so on.

2. On the second pass, run your spelling checker over the text. Then read the text so that you don not muck mistakes like having correctly spelled words, but ones that makes non sense within the context, or where words words appear more than once. Turn your grammar checker to ‘technical’ and check the grammar.

3. On your third pass, check the structure. Make the argument logical. Make sure ideas flow and link appropriately together. Challenge your ideas and make sure the answers are there somewhere. Make sure paragraphs really are paragraphs. Do the same for sentences, avoiding literary devices like short sentence fragments. This is technical writing.
4. On your fourth pass, check the tense. Make sure actions that are complete are expressed in past tense and those that are time-invariant are in the present. See the section below on this.

5. Scan you entire document for ‘I’ (and ‘we’) and eliminate. That should require some editing, but that should be used as an opportunity to tighten the text. Note; ‘the author’ is the same as “I” – do not use it!

6. Now scan again for grammar. Make sure things that are plural use plural verbs and vice versa. Make sure there are no split infinitives. (Do you know what they are?) Make sure adverbs precede verbs. (Adverbs are those words which mostly end in ‘ly’ and which sporting commentators cannot pronounce. As, for example, in that hoary old favourite ‘all the boys done a real good job’. ) Make sure you avoid cliches like that in the preceding sentence. Make sure your sentence structures conform to accepted standards. Make sure your sentences clearly state your message and do not go on for too long or use too many words like conceptualising because long Latin words are confusing and long sentences make it difficult for a reader to follow the argument and understand what it is that you are trying to say and also do not believe that this problem can be overcome by punctuation because if your read a good book on English you will discover that this is not really the purpose of punctuation.
6. Scan for punctuation. Beware of using ; or : unless you really know how to use them and watch the use of commas. A small point about commas; in a sentence you should generally have ‘,but’ but rarely ‘,and’. In a thesis, you would never use ! and rhetorical questions are out of the question so you have no need to use ? either. You also generally avoid foreign words unless there is a good technical reason to use them and you never underline words or otherwise emphasise as, once more, this has no place in a thesis. That is like email shouting.

7. Now scan for the simple things. That is, text where you inadvertently put in too many spaces due to editing, or where you typed a comma as the last one in this sentence and made it look like a shag on a rock. Or where you do the same to a full stop. Check that the thesis conforms to the requirements listed ahead.

7.4 The draft

It is a requirement of the project that you MUST submit a draft of your report to your Supervisor. There are several reasons why:

1. Someone needs to check that your technical content is correct.

2. You are far too familiar with the work. You need someone to check to make sure there is nothing left out.

3. You might need some ideas on how to better communicate your work.

Your draft is NOT assessed.
YOUR DRAFT MUST BE PRESENTED AT LEAST 10 WORKING DAYS BEFORE THE THESIS SUBMISSION DATE. IF IT IS NOT SUBMITTED, YOU MAY BE FAILED

It is natural for students to want to know what is expected and so to refer to past projects. There are two comments to make here. First, the final project result depends on more than just the project report alone. Second, note that there have been changes in format in recent years and in assessment.

Your supervisor will not correct your English. They will point out there is a problem, but the thesis must be in YOUR words. If your written English is not good, then do some reading on technical writing and/or attend a workshop. You may NOT get someone to write the thesis for you or substantially write it.

7.5 Format of the thesis

7.5.1 Introduction

All theses will be checked by the Projects Coordinator to ensure they meet the Department’s standards. Theses not meeting the requirements will be rejected and you will be required to amend them before they are assessed. YOU WILL BE PENALISED IF YOUR THESIS IS REJECTED. See the checklist at the end of this document
This Guide is in exactly the format required. A more literary style of writing has been used and the margins differ, but the structure is the same.

### 7.5.2 Physical presentation

The physical presentation must conform to these standards:

1. The thesis must be printed on a modern laser or ink-jet printer. Handwriting is unacceptable in **ALL** circumstances. In particular, handwritten symbols must NOT be used.

2. Use A4 size paper and if not from the same ream then ensure it has the same **colour**. You should check the quality of the paper ensuring that it has no flaws, is not water damaged or creased.

3. Schematics or large drawings may be produced on larger size sheets, but folded to fit in an A4 format. These may only be placed in an appendix. Sketches are **not** acceptable.

4. Only **one** font may be used for the text; a standard 12 point serif font such as Times or Bookman is best. You may use a san serif font like Helvetica or Arial for headings if you wish.

5. On each page, the margins are to be as follows:
   - Top 2.5 cms
   - Bottom 2.5 cms
   - Left 4 cms
   - Right 2.5 cms

   Typing is to be on one side only.
6. Typing is to be **double spaced** and **justified**. Words may not be split at the end of sentences. Paragraphs are not to be indented.

7. All headings are to be left-justified. Sub-divisions of the form ‘2.3.1’ are to be indented an additional one centimetre. You should be questioning your structure if you proceed to a ‘2.3.1.1’, but of you feel the necessity, indent a further centimetre.

8. All chapters are to begin on a new page.

9. Figures and tables **ideally** should be placed at the top of a page and centred. Use your discretion on this, but try and be consistent. Do not wrap text around a diagram. Ensure all diagrams are numbered and have a title. See ahead for details. A figure means a graph, photograph, schematic, drawing or a set of these.

10. Pages are to be numbered from the **first chapter**. The numbers are to be placed, without punctuation in the centre of the page at a point 1.5 cms up from the **bottom** edge.

11. Pages prior to Chapter 1.0 are to be numbered using Roman numerals starting from the page after the Introductory Letter. These numbers are also to be without punctuation in the centre of the page at a point 1.5 cms up from the bottom edge.

12. Headings must be as per this Guide. However, you may highlight by either underlining or using bold or colour as here or some similar scheme. Note the use of capitals in chapter headings, but their more limited use in other headings. See the later comments.

13. See the later comments on numbering.
7.5.3 The thesis binder

For an undergraduate thesis, you will need to organize a cloth-bound ‘pillar and post’ binder and present your thesis in that. Only use one of the recommended bookbinders as only they are permitted to use the Curtin logo. Some details on the binder:

1. The binder is to be 305mm by 220mm and cloth.
2. The spine is preferably 15 mm thick, but if your document is sufficiently thick, then you may extend it to 30mm.
3. There are to be brass inter-screws to hold the document.
4. The inside of the binder is to be lined.
5. The colour of the binding is green for Bachelor of Technology theses and black for Bachelor of Engineering.

The Bookbinder you choose will not accept your order unless you give them an authorization letter signed by the Projects Coordinator or their nominee. See the Project Home in the Department’s web site for full details of the approved binders and the authorization form.

The basic format of the binder is as follows. On the spine will be:

Your initials and family name.

Your course such as B.E. ( Electrical Power Engineering )

The year

On the front cover of the thesis will be:
The Curtin logo

Your full name in the way you normally express it. For example, if you are of Chinese origin then that is most likely your family name followed by your given name.

The full thesis title.

You are only required to submit one bound thesis and this is at your cost. You need to punch your paper copy and screw it into the binder.

Graduate theses – both coursework and research - are bound like a book in black cloth. For coursework masters, you must organize the binding. For a research degree, binding is organised by the library after the thesis has been examined. The Graduate Handbook gives details.

Given the thesis cover is a standard width, then what do you do if you have a very large thesis? This is an unusual situation, and you should see the Projects Coordinator.

7.5.4 Writing style

The thesis must be written in grammatically correct English. Given the ready availability of spelling and grammar checkers, there is no excuse for obvious mistakes. Spelling is to conform to Australian standards, not U.S. or British. The reference you should use is the Macquarie dictionary. All values must be quoted in SI units (unless you are referring to historical information).
If you are uncertain of how to write a thesis some standard reference are:

Anderson, J., Burston, B.H., Poole, M.E. Thesis and Assignment Writing


Both are in the Library and the second is available online from the University of South Australia. Note these are only guides; the required standard is that discussed here.

If you are uncertain on how to write English properly, then you should also consult a standard reference. A very good little book for this is:

Bailey, R.F. A Survival Kit for Writing English

This is very good if you are uncertain on how to use punctuation, especially colons, semi-colons and commas within sentences. Please note in these and similar books the comments on how to form paragraphs and sentences.

Some of the basic issues in writing a thesis have already been discussed. In particular:

1. It is a factual document that describes technical activities. Therefore, it is devoid of literary devices such as fragments, exclamations, iambic pentameters and so forth. Note that factual also means words like ‘about’ are rarely used, and expressions like ‘the blades rotated quite fast’ are replaced with an exact value of speed or a reasonable estimate.
2. It does not employ underlining or bold within the body of the text. They are only used with headings. It is a justification of decisions made and actions taken, thus it is written in the third person. That is, it was done, not I or we did. Very rarely, if ever, do you ever need to specify yourself and in those very rare circumstances you are ‘the author’.

By far the major problem in writing a thesis is dealing with tenses:

1. A thesis writes about events, artifacts and knowledge.

2. The events should have completed when the thesis is written. Hence decisions were made, measurements were taken. Report events in the past tense to indicate that completion.

3. If an event is not complete - for example, a standards committee is still meeting – then you need to indicate that. Typically you would state “at the time of writing, the Committee has yet to reach a decision, but it is widely believed...”. That is, highlight the fact the event will conclude at some future time, and probably has by the time most readers begin examining your thesis.

4. Artifacts may be referred to in generic terms or specific. For example, the 68HC11 microprocessor as a device to program or a specific one you used to implement part of your project. The generic artifact may still exist at the time of writing – because it is still manufactured – or it may not. Specific copies may exist too, but then the one you actually used may have been destroyed.
Thus you need to exercise some care on how you refer to artifacts, taking into account the situation at the time of writing. In most instances, though, you will find the 68HC11 is a microprocessor at the time you write your thesis, but of course your tests of it were done in some way.

3. Knowledge is quite easy to deal with, but it may seem a little confusing. To illustrate, Jones might have written a paper in 1989 in which he expressed a particular opinion. Then in 1995 he might have had a different opinion. If you are referring to the first paper, is this “Jones stated” or “Jones states”? The answer is the second, because that opinion was published and so remains evermore. It has become knowledge. You might include in the text that Jones changed his mind because it is important to your discussion, but his first opinion is still an “is”.

Some other elements of writing style:

1. As a general rule, if a number is between one and ten, then spell it out. If it is larger, leave it in numeric form. For example, “over the course of ten meetings, the standards committee…” but “on no account must more than 1000 volts be applied to this system”. However, if you are dealing with very explicit numeric values - measurements for example, - then remain in numeric form.
2. Do **NOT** use abbreviations. That includes contractions like “don’t”, but more particularly ‘etc’, ‘e.g’, ‘viz.’, ‘i.e’. ‘cf’, ‘Q.E.D’ and so forth.

3. Do not use symbols unless they are part of a measurement or standard descriptor such as a URL. That is, ignore %, &, +, -, @ and so on. Spell them out.

4. Do not use foreign words unless there is a very good reason.

5. Some Latin words commonly used in referencing may be considered if you wish. One that is very standard is ‘et al.’, literally ‘and others’ used when there are multiple authors. Another useful one is ‘ibid’ meaning that you are referring to the last work cited. If it is to another page, you use (ibid, p.10). Others that are used like ‘op. cit.’ require some care in their use. A final useful term is ‘(sic)’ meaning that what you are citing is exactly as was written. This is normally used in literature when in your opinion there is a grammatical or spelling error. A thesis accepts there are several standard spellings. Thus this is rarely used in a thesis, the exception being mis-spelt names, places and quantities.

6. Do **NOT** use footnotes unless they are absolutely essential. There are very, very few circumstances where they are needed in a technical thesis.

**7.5.5 The written structure of the thesis**

There is a defined format for all forms of theses in the Department, namely:
Title page
Documentation sheet
Synopsis
Submission letter
Acknowledgements
Nomenclature
Index
Body of the Thesis
References
Books, journals references, web references.
Appendix 1
The project plan and amendments
Other Appendices
Implementation details, overview of standards (if relevant), etc

It is expected the body of the thesis would contain these elements:

Introduction
Justification of the problem and the application of solutions
Overview of the solution proposed
Statement of personal achievements
Thesis outline
Background
Critique of current practice.
Review of the theoretical issues (and others) relevant to the problem (where appropriate)
Detailed problem definition and solution requirements.

Problem solution
Arguments indicating how and why the solution has been identified or chosen. Refer to appropriately presented supporting data such as graphics, tables and so forth.

Implementation
Overview of the implementation or simulation of an implementation

Verification
Outline of the means devised to verify the solution meets requirements and the results achieved.

Conclusions
Critical analysis - an intellectual examination - of the outcomes.
Outline of future development, highlighting particular areas you consider are worth pursuing and why
In more detail, the elements of the structure are as follows:

1. **TITLE PAGE**

   This must be the very first page of your thesis.

   There is a download you will find at the Project Home with the Curtin logo upon it, use that and print on it something like:

   
   **A Study of Pseudo Random Binary Sequences**

   by

   **Joseph P.B. Jones**

   
   *A thesis submitted for the degree of*

   **Bachelor of Engineering in Electronic and Communications Engineering**

   Your title needs to be chosen in conjunction with your supervisor, but in essence it needs to be built about the principal keyword that best describes your project.

2. **DOCUMENTATION SHEET**

   Blanks are obtainable again from the Projects Home are on the Department’s web site. You need two copies; one to be included within the bound thesis and one to be handed in separately. The various sections must be typed.
These sheets are eventually published by the Department in an index of theses produced within the Department each year.

3. SYNOPSIS/ABSTRACT

This is a single paragraph, on very rare occasions perhaps two, that briefly expands on the title. It is an abstract of the thesis and you may call it that of you wish. An example:

A programmable pseudo random binary sequence generator has been constructed for the testing of communications circuits up to video frequencies. The unit may be programmed for both bandwidth and sequence length and, if desired, with a programmable DC offset.

The synopsis is not a summary of the project; that is provided elsewhere. Rather, it links all the main keywords of the thesis into one paragraph to flag the exact character of the solution provided.

4. INTRODUCTORY LETTER

This is a formal letter to the Head of Department. Begin with your current address and a date. (Do get the name of the Department and the Head’s name and title correct. Do not include headings; it is a letter.) In this letter you offer the thesis as partially satisfying the requirements for the particular degree in which you are enrolled. It is partially satisfying as you have to pass a number of units other than the project units to graduate, and even within the project units themselves there are other assessment components.
Double degree students please note this thesis is only for the engineering degree in which you are enrolled.

Second, you **MUST** state this thesis is entirely your own work outside of where acknowledgement is given. You **must** sign this letter.

5. **ACKNOWLEDGEMENTS**

Acknowledgements are a formal component of the thesis to identify any assistance directly given to you in undertaking the work being reported. That is to say, without that assistance certain parts of the thesis could be presented. Thus that means in general terms you **only** mention:

1. your Supervisor, if only so we and others know who it was;
2. any member of the technical staff who offered special assistance;
3. anyone who helped you (for free) in the typing of the thesis or production of figures;
4. anyone who edited your thesis and corrected your English;
5. the name of any Scholarship provider who supported your studies;
6. if you received time-release from an employer, then that employer;
7. if an industry project, who was the sponsor;
8. any company that donated parts or other services.
What you do **NOT** do is thank parents, friends, God, spouses, your local pizza delivery service, your housemates and so forth. Their support may have been psychologically rewarding or expected, or more a case of tolerance. However, nothing they did or did not do would have made this thesis different. Further, that support extended to all units, not just the project units. Note too, a thesis is not a book and a dedication is **not** appropriate.

6. **NOMENCLATURE**

This is an *optional* section to be used **ONLY** if you use a large number of symbols *unfamiliar* to your expected readership. List them and their definition. A nomenclature is provided as a courtesy for a reader at the front of a thesis so they can check the symbols while they read. Further, as a general rule of thumb, **only** include a nomenclature page if you have *at least* a page of unfamiliar symbols. In the previous example, the author might have listed:

- **F(N)**  Euler’s totient function
- **w(N)**  The number of distinct prime divisors of N
- **p(N)**  The prime number distribution function

as these are unfamiliar to most electrical engineers. Also include here any acronyms you may devise. Remember that the prime readers are the examiners. Listing frequency, impedance, TCP, IP, and such like is just offensive.
7. INDEX

List the chapters in order with their headings, all sub-sections with their headings in that chapter, all the sub-sub headings and so on. In each case, list the page number on which they are found. Note the format of the index in this guide; it is exactly in the format required. On the following page, list all figures and tables with their page numbers.

8. INTRODUCTION

This is the first actual chapter of your project and as mentioned earlier, it needs at least three subsections.

Section 1.1 presents the ‘big picture’ and justifies why the project is important. This is usually like (although this is quite abbreviated):

*The potential impact of terrorist acts requires a much higher level of vigilance at many public sites. However, this cannot be provided for economic and other reasons simply by extending the security forces. A means of solving this problem is by automated face recognition systems. Unfortunately, these work poorly in low contrast environments or where much of the face is hidden. This thesis examines the problem of object detection in low contrast images.*

It is also appropriate at this point to comment on possible applications of the project, especially in an undergraduate project.
For an undergraduate project, it is enough to establish the broad need for the solution. For graduate theses, the justification needs to become stronger. Thus the implication is why did this problem need to be solved, not just that it could. For research theses, this is extremely important.

Section 1.2 of the introduction is a formal requirement of the thesis. You need to identify the novel or important feature of your work; what are you claiming as the intellectual achievement of the thesis. Note that. It is not what you created, but what you are claiming is particularly noteworthy about the ideas that lead to you creating it. For a graduate thesis this is particularly important. This part would be along the lines of:

   A solution to the problem of XXX has been found by combining YYY’s proposal with ZZZs. A simulation has demonstrated the value of this.

While this is a formal requirement, you should also attempt to ‘wet the reader’s appetite’ and briefly outline the good things to come. These are, of course, your achievements.

Section 1.3 is also straightforward. It simply outlines exactly what is in the thesis and so points to where these good things lie.
Are there only to be three sub-sections? In general, yes but this is not fixed by any means. For example, if a project was to develop an electric vehicle to be entered into a competition, then another section describing the competition and perhaps even the outcome is in order. It is a question of judgement. Also, for a joint project like this it is an idea to have a section outlining that project, the other team members and the specific problems they tackled within the overall project plus reference their theses.

9. BACKGROUND TO THE PROBLEM

This is a critical part of any thesis. Do note that in some circumstances - mainly graduate - two or more chapters may be needed. There are also some very rare circumstances where no background chapter is needed.

This chapter is one of the most misunderstood sections of a thesis and so some explanation of its rational and what should be in it is needed.

Every technical problem has a background of some form. Various people will have either examined the problem before, thus there will be a range of tested solutions, or they will have contributed to parts of the problem as in research topics. You need to find that knowledge and understand it. Then you write that understanding as a chapter ( or perhaps two ) of your thesis.
Note that this chapter is not a tutorial; it is a justification. With this chapter you are stating that any solution you propose should be treated seriously because you understand what you are doing. The way you write it will indicate what you see as significant, what you see as the important developments, what you see as being the key tools and concepts needed to solve the problem, and so on. It needs to be tightly written with many references.

There is one small variation to this. Occasionally, you might find some theory or knowledge that is not widely known to the expected readers of your thesis but critical to it. For example, a mathematical theory such as elliptic curves in number theory. Alternatively, if you are developing a modification for an instrument used in spectroscopy, then you might see it as important to discuss spectroscopy. This is far more likely with a graduate thesis than an undergraduate. Then you might like to have a chapter to develop that. Again, though, it needs to express your understanding. What influenced your actions and why.

10. YOUR WORK

In the next few chapters, you outline clearly and logically the work you have performed, together with all test results. Try to present this in the sequence; the problem, a solution, verification of the solution.
11. CONCLUSIONS

Conclusions is always the final chapter of a thesis and again a very critical part. Again, it is widely misunderstood section. A point to stress is that this chapter is not a summary. That is, it is not “a” conclusion. Conclusions – and it is plural - means an intellectual analysis of your work, assessing both strengths and weaknesses, and the implications for those that follow you.

An important part of conclusions is discussing the question “where to from here”. You are now thoroughly expert in this problem and so you are now in an excellent position to nominate the way forward. This is an important intellectual contribution you can make and your reasoning will demonstrate your abilities very well.

12. REFERENCES

A reference list follows the conclusions and is treated much like a chapter. Every work you mention here MUST be referenced in the body of the text. Referencing is not trivial. See the later sections.

It is very important to stress this is NOT a reading list. Rather, it is flagging to the reader where they can find answers to some of the claims you have made or opinions you have expressed.
A thesis rarely includes a reading list. If it does then it is an Appendix. A circumstance where you might see a need for one is where a standard took some years to develop and for some reason you see a need to have chronology of the developments leading to that standard. Another might be that you see the need to list the full set of documentation on some issue such as legislation and accompanying regulations, but in the thesis proper you only refer to a small section of it. However, to stress again it is a very rare circumstance and should not in general be considered.

13. APPENDICES

Appendices serve several purposes. The main reason for them is simply to report information that needs to be reported but which is of secondary importance. For example, a lengthy mathematical derivation or a test procedure. To include it in a chapter would only distract the reader. There is also information that needs to be reported, but which has no real place in the body of the thesis. For example, operation manuals for equipment you have developed, large tables, component data, design formulae, summaries of standards and your cost estimation. Schematics, flow charts, software listings, PCB designs and so forth also belong in an appendix. Each appendix must cover just one topic, but there is no limit on the number of appendices.
It is difficult to imagine a thesis without appendices. Indeed, sometimes the appendices form the bulk of the thesis. In this case, you may place them on a CD or DVD and fasten that to the inside back cover. Include in the thesis proper a page stating which appendices are on that CD or DVD.

Do **NOT** include data sheets in appendices or other copyright materials unless you have the express permission of the copyright holder to reproduce them. Otherwise, you are in violation of the copyright act as well as University regulations and you will receive an automatic F grade. Even where permission is gained, why they should be included? If they are readily available in Handbooks, then there is no point. They should be referenced.

### 7.5.6 Numbering in theses

Numbering in theses is a topic that confuses many students. There are four key topics to discuss here:

- Numbering of headings
- Numbering of equations
- Numbering of figures and tables
- Lists

The first is the cause of most problems and the single largest reason why theses are rejected. **Please note this Guide uses the required format.**
A thesis is basically a very large block of text with a title that describes the entire thesis. If left in this form, no reader could find the parts of the thesis of interest to them. Thus the text is partitioned into chapters and each is given a heading preceded by a number of the form 1.0, 2.0, 3.0 and so on. The chapter heading describes that chapter alone, but it also describes some part of the thesis title. So, if the thesis title is “a new means of designing low noise power amplifiers” the chapter headings would cover existing methods of design, the new method, tests of the new method and so on.

While dividing a thesis into chapters helps a reader to navigate, some chapters can be very large. Again, to assist the reader it is useful to break them down into sub-divisions. Then each sub-section is given a number of the form 2.1, 2.2, 2.3, etc plus a heading. That sub-division heading only applies to the text that follows, but it is a sub-topic of the chapter heading.

Where students invariably fall down is in making the next division if that is deemed necessary. Exactly the same procedure is followed as before. Assume a section 2.2. It might be on, for example, on the design of particular amplifiers and there might be ten of these to discuss. The heading of 2.2 will in some way indicate this entire section is devoted to discussing amplifiers. Each sub-subheading will have a number – 2.2.1, 2.2.2, 2.2.3, etc and a heading that will describe a particular amplifier. That is, again the heading refers to an aspect of the heading at the higher level.
One point of confusion is the use of the heading “Introduction”. Chapter 1 is almost always called “Introduction” because it introduced the thesis. Subdivision 2.1 can be called “Introduction” if it introduces chapter 2. That is, it describes what is in chapter 2 in some way. The further subdivision 3.3.1 can be called “Introduction” if again it introduces. At this level it might flag you are aware there are many forms of amplifiers but here you wish to focus on just ten because they have certain general desirable properties.

Do not consider any sub-division beyond three levels. To do so is virtually numbering paragraphs and that is ridiculous; use a list. There are very rare circumstances that justify going to 2.2.2.1 for example.

There are several reasons for numbering in this way. It is logical and neatly divides information into appropriate sections. That encourages the writer to create a logical work. It also makes it easier for a reader to locate information. Unlike a book, a thesis does not have a topic index at the rear. However, numbering sections and chapters, and having an index at the front makes locating information quite easy. The reader now knows the scope of text that each heading covers. Thus a 3.0 heading covers an entire chapter, a 3.2 a section where this may include a 3.2.1 and 3.2.2 that cover specific issues of the heading of 3.2, and so on. To do as so many students do have a section, say 3.3 with text following and then a 3.3.1 means that there is text hidden to the reader. That is unacceptable in a thesis.
Every piece of text in a thesis has at least one number and label associated with it and it can be three. Consider the following part of an index:

2.2 Chroma Lock

2.2.1 Overview

2.2.2 Principles of Chroma Lock

2.2.3 Advantages of Chroma Lock

2.2.4 Disadvantages of Chroma Lock

Some minor points to consider first. Under **ALL** circumstances, a heading such as 2.2.3 is **indented** within the index and within the body of the report. Under **NO** circumstances is text indented, especially the start of paragraphs.

Review the process of division here. This fragment means that section 2.2 discusses Chroma Lock as a whole regardless of the sub-divisions that exist. The implication of the sub-divisions is that each discusses a **specific** topic under the general heading of chroma lock. The first, 2.2.1, presents the overall picture and implies why this subdivision is chosen. It is an **introduction** to this section as a whole and there is absolutely no reason why it should not be called that. Clearly, there is quite a distinction between the chapter ‘1.0 Introduction’ that introduces the thesis as a whole and ‘2.2.1 Introduction’ introducing this discussion on chroma lock. To stress again, the text that follows this heading is described directly as 2.2.1 overview, it is also described by 2.2 Chroma lock implying it is an overview of something applying to that, it is further described by the heading of 2.0 and so is linked into background and finally it is described by the thesis title.
Numbering equations is a little vexed. In general, only number them if you reference them. That normally means just the final result, not the intermediate terms. Equations are numbered in the form 2.1 meaning this is the first equation referenced in chapter 2. Equations are numbered from 1 to the final equation in the chapter.

Numbering of figures and tables follows a similar style. If a figure appears in chapter 2, then it is figure 2.x. Simply number them from 1 in the order in which they are quoted in the text. Tables are numbered in the same way. Text, figures and tables are not linked when it comes to numbering.

The convention in a thesis is that there is a separate index for figures, then tables if you have them, but not equations. Each figure and table is to be numbered in the form “Figure 2.1: title”. The title should clearly state what the figure is about. If you have taken this figure or table from a reference or plotted the data from a table elsewhere, list below the title in brackets the reference and whatever appropriate terms you see fit. For example “(Taken from Jones et al, 1991, but plotted against logarithmic time ).

Lists often occur in a thesis. In general, only list items if each is described by words, sentences or a paragraph. If you require more than this, you probably need to go to a third level of sectioning. A list of words is usually just presented as that list indented. If it is a list of sentences or paragraphs, then it should be a numbered list with a format like the following:
If you need to go to greater depth, then re-structure. Note the indenting

7.5.7 References
Curtin now uses the Chicago format for references and this applies to all Curtin publications, reports and theses. Details can be found on the library web site under Guides. However, this is a clumsy format for technical thesis, so you may if you wish use the IEEE format BUT not a mixture.

The key difference between the two is Chicago references like:

1. (Jones, 1991)
3. Jones (1991a)

in the body of the text. It emphasizes the year of publication and the list of references is in alphabetical order. IEEE however, just references in the form of (31) where this is the 31st entry in the list of references, and that list is formed in the order in which they are referenced in the thesis.
This may seem a small issue but a technical work often quotes multiple references in the one sentence and this makes IEEE much more attractive.

Some examples of how to reference using IEEE:

1. “The standard formula ( 21) for this is: ”
2. “This conclusion, though, can be disputed ( 33 ).”
3. “Jones (52) showed that... and then later (53 )”

Note that you can reference an author by name if you wish. You do not have to repeatedly reference if your text makes it clear you are still drawing on the one source. Use ibid as appropriate.

The situation with multiple authors is a little complex. The convention is that two authors are always quoted. If there are more than two authors, then the first time you quote them you use all their names as in “Smith, Jones and Leeman (39) give an alternative...” , but from then on “Now it follows from Smith et al ( 39 )”.

Where referencing can get complicated. You are doing a project with Western Power and one of their senior engineers tells you that you should do something is in this particular way. Alternatively, you contact someone about a part and they tell you all sorts of things that aren’t in the data sheets. Here, someone has provided a specific service applicable at only one point of your project and it is quite detailed. It is not really appropriate to mention them in Acknowledgements because you want to refer to that specific item.
How do you state their advice/opinion/service? The answer is exactly as for any other reference, but now in the References, what you list is:

Jones, R.B. Personal communication. 2010

You do not have to be more specific than that. Note that the **ONLY** time you quote spoken words is when they are a personal communication or when the speech is archived in some public domain archive. You do not cite hearsay.

What happens if you access a reference such as an industry white paper where no author is stated? If the paper is issued under the name of a company, make that the reference. Otherwise, it is clearly a publication of that famous author Anon.

The reference list obviously assumes some importance here. The first thing to note is that Chicago and IEEE differ on how it is organized. For IEEE, references are added to the list as they are referenced in the text. Further:

1. For a Journal articles, the format is:


   Note the use of commas and full stops. Also that the title is expressed as a sentence and the Journal name is underlined. The title is expressed in abbreviated form; the standard abbreviation
used. The number following means the volume number. Do not include the month, but if it is publisher’s convention to highlight the part, then include that. Finally, there are the page numbers.

2. For books, the format is:


If you wish to refer to a specific part of the book or if it is a compilation, the format is:


4. If you need to cite a reference, but you cannot locate it to verify its contents, then what you should do is something along the following lines:

5. If you wish to reference a databook, then it is like:


6. For company reports, etc., use ‘Internal Report’ or ‘Unpublished Report’ as appropriate.

7. Web-based materials present quite a problem. One difficulty is that web URLs can frequently change. Therefore, a standard method of referencing is to follow the above format, but to include at the end:

Downloaded from <URL> in July 2007.

Many University sites – and indeed others – have another defining name. For example, they are the Department of Electrical Engineering, or the Systems Research Institute. If this is the case, then cite that as well. The objective here is to give the reader enough information so that they can locate the article or whatever through a search engine if the URL should change.
A more serious academic problem you need to consider is that much web material is not peer reviewed and so academically suspect. Hence you need to treat it with some caution.

There are now many different web sources. For example, databases, discussion forums, downloads, web pages and so on. Examine the standards listed at the earlier web site just to confirm what you should do in each particular circumstance. Be very cautious of obvious databases, especially CGI sources, as here web pages are composed ‘on the fly’ and so the contents can very easily change over quite short periods.

7.6 Theses for projects that are software-based

You may be doing a project that in part or whole is concerned with software. Some students become confused on how to write a report in these circumstances. However, it is really no different from any other thesis. Some general comments:

1. Any software system has an architecture developed from the specifications. That is, a structure or form and a behaviour. That is to say, this is what a GUI will do when the user does this particular action. This will often be part of the overall design process. If so, then you may need a separate chapter to describe this part of your design.
2. Software does not just happen; it is engineered. You choose or devise algorithms, then you determine data and control flows in some way. Then the body of the thesis describes these intellectual activities you undertook and why you made the decisions that you did. That may require you to discuss some code fragments, but that is all. The full source code is really of limited interest and so would normally be placed in an Appendix. Note that for code you can use 10 point font, you may use a different font to the main thesis and you do not have to make this text double spaced. It should be source code as you produced it in an editor.

3. The software has an implementation - the code - in a particular language – C, Java, Lisp, Perl, Python, Eiffel, APL or whatever - it is targeted at a particular operating system and it may also be targeted at a particular GUI interface such as X-windows or Cocoa. You need to indicate the reasons for your choice of these in the body of the text.

7.7 Graduate theses

These same conditions apply to graduate coursework theses. The only real difference is that that a more exacting standard applies for content. The requirements for research theses are listed in the Graduate Handbook. Note the following for these:
1. There is no letter or documentation sheets.

2. As mentioned, the background chapter is vital in a graduate thesis and almost mandatory. Unlike an undergraduate thesis, its purpose is to show a very thorough literature survey of the field and an ability to critically analyse in some detail.

3. The format is as largely as described. However, the thesis itself will be bound by the Library only after your thesis is accepted. Prior to that, it is given a temporary binding only. You are required to pay for this.

4. You are required to submit multiple copies of your work. See the Graduate Handbook for details.

### 7.8 Attachments to the thesis

Many students may wish to include very large data sets, images, animations, simulations, copies of software and so forth to their thesis. Three comments.:

1. Please use a CD or DVD.

2. Include an appendix to describe the contents of the disk, the software used to prepare them, the recording format (as a thesis is held for a very long time) and also to which operating systems it is compatible.

3. Most importantly, fix the CD or DVD in a pocket in the back of the thesis folder. Do note this CD or DVD is NOT the same as the electronic copy of the thesis.
7.9 The electronic copy of your thesis

You are required to submit an electronic copy of your thesis. Then:

1. Please supply this on a CD (or DVD) or stub.

2. Label the CD with your name and the year. Put a physical label on the CD using a permanent pen and put a small Readme file on the CD itself with your name, student ID, email and postal address.

3. The text can be in Word (the current version is available on most university machines) or pdf. **DO NOT PROVIDE IT IN OTHER FORMATS.**

4. The CD should contain an exact copy of your thesis. However, if your hard copy also includes a CD, include that directly into your appendices. This means there is a slight difference between the two copies; your hard copy has a sheet stating the appendices are in the CD attached to the rear of the thesis, but they are directly included in the electronic. This is the ONLY difference allowed.

7.10 Summary

What is a thesis?

A communication between you and your examiners focusing on the reasoning behind decisions made.

What purpose does it serve?

A means of assessing your ability. It helps you get a job.

It records a completed engineering activity

It demonstrates the capabilities of our graduates.
*How is it written?*

Past tense because it records actions taken and completed.

Third person because you are expressing your views. Do NOT use we; YOU are explaining. Do NOT use ‘the author’ or other subterfuges for “I”.

All opinions are yours unless you reference someone else’s.

Think on how the examiner will read it when you write your thesis.

Write, review and edit frequently

*Your examiners*

They examine, so they are not learning. Remember they are expert.

*The initial structure of the thesis*

Title – make it your main keyword

Synopsis – an overview [paragraph](#) – based on other keywords

Index – shows the structure of the thesis – use meaningful headings

*Planning the thesis*

Write the title synopsis and then a [tentative](#) index.

Now put down bullet points for those heading and strike a balance

*The body of a thesis*

Introduction

Why is this project important

What was achieved

Structure of the thesis

Background
Your understanding and interpretation of the current ‘state of the art’; do NOT write a tutorial.

Reference most material; only discuss what is important to the project.

Do NOT call it background; link it to the ‘art’ discussed

Detailed problem statement

Detailed problem solution

Verification of the proposed solution

Conclusions

Comment on the significance of what was achieved

Comment on how appropriate were the methods used

Discuss where to from here? Outline the next step as you see it.

The draft

YOU MUST PRESENT A DRAFT

You need to do that to get an objective opinion on how to strengthen it.

The physical format

Read section 6 carefully

Note the documentation sheets plus the blank sheet with logo on the web site for your formal letter.

Note 7.5.6 on numbering very carefully.

Referencing; use either I.E.E.E. preferably or Chicago.

Attachments

Fold large attachments like schematics to A4 and attach in appendices
Put bulk data, videos, code, etc in a CD and attach to the inside rear cover.

Electronic copy of the thesis

On a CD or DVD (or stub), and label it

Include a README on the disk with your name, degree, project title.

Only use Word or PDF

If you have CD in the hardcopy, merge it with the electronic copy.
8.0 GENERAL COMMENTS

8.1 Are you going to solve the world’s problems?

Something that tends to dominate student thinking about projects is what is a successful project? What you need to recognise is that there are several viewpoints about this. They are not mutually exclusive, but one thing that is (almost) certain is that your idea of success is quite wrong.

Success from your viewpoint means achieving the project objectives. Have you shown us that you have the methodical approach, the fault finding skills and the flair to be a professional in your field? Show us your ability! If you do, then we will award you the appropriate assessment. From the Department’s point of view, though, a successful project is also one that extends you. If you fail to learn something, if it doesn’t change your attitudes and opens your mind to what engineering is all about, then it is a dismal failure. The Department tries to offer challenging projects to ensure this, but it cannot guarantee that in every case.

Students often think that what is important is to ‘finish’ the project. Finish? In what way? Do you mean that it worked? Well, what were the specifications? How were they arrived at? Does this project meet Australian environmental standards? (We mean for electrical or electronic equipment. You might find it useful to locate the relevant Australian standards and read them. They are in the Library.) Has it been designed for manufacturability? Of course not!
No matter how good, no student project is ever ‘finished’. All anyone can claim is that feasibility was proved. Your project is very much a first prototype and is anything but a useful piece of technology. However, if you have done your job properly - clearly defined tests, a methodical investigation, an examination of all the pertinent issues - then it should be a relatively simple matter to create a genuine, working system from it.

What is really wrong about this attitude though, is that it fails to recognise any form of engineering is systematic. This is why you have a project plan. Thus the only meaningful interpretation of ‘finished’ must be that the plan as outlined was accomplished.

We said at the beginning of this Guide that the project is an attempt to introduce engineering to you. To link up lots of loose ends and to show you how it all fits together. Ahem. Not totally true. No project is really engineering per se. It is primarily an educational exercise and if it fails in that then it achieves nothing. Now in industry, you maximise your rewards by finding ways of avoiding problems and lowering costs. That is, industry rewards you on the basis of the dollars your work generates. Universities in contrast reward you for the intellectual skills you demonstrate. Here, you will maximise your rewards in two ways. First, through the manner in which you have planned, executed and reported your investigation. Second, in contrast to industry, in the way you have sought out and solved problems.
The first of these issues essentially relates to the thesis. That is your direct means of methodically relating what you have done. The second relates to what you are reporting. Then what you should be doing at every stage of your project is seeking out problems and finding ways around them. If your design seems temperature dependent, then find out why. If a component keeps burning out, investigate it. If you have to continually re-calibrate your system, something is amiss and it’s hardly practical, so find a way around it. The more problems you solve, then the more ‘meaty’ your thesis and the better your prospects. If you cannot solve a problem, don’t ignore it; discuss how far you got in solving it. Always remember that what you are trying to draw attention to is your skill as a professional.

If you are bashful about your abilities and try to disguise them, do remember staff read many theses each semester and most have been reading them for years. We are quite skilled in detecting inadequacy. If you do fool us then, you probably do have the ability and, for your future career, you would have been better off being honest.

8.2 Extensions, deferments and supplementaries

To stress again, if ‘finish’ means to complete your project plan – the one you completed before you began serious work – then there is no case for extensions. Similarly, as your project is supervised, then there is absolutely no case for a supplementary. If you fail to keep to the plan, then you are failing to satisfy project requirements and so you have no grounds for either.
If you suffer serious injury or illness during the project, or if you have a major personal crisis in your life – a close relative or friend dies for example – likely to prevent you working on your project for some time, then contact your Supervisor immediately. You can withdraw in these circumstances. Your case will be argued at the Board of Examiners and you can then carry on without penalty in the next semester. This is dependent on your Supervisor agreeing you have been diligent up to that point.

Under very extenuating circumstances, a deferment may be granted but only for situations where there is a last minute, unforeseen event like:

1. the house you share is burnt down and you lose the disks with your thesis on it and all your back-ups;
2. you have an accident on the freeway on your motorbike while trying to deliver your thesis and end up in hospital with two broken legs;
3. you are a part-time student and are called to an emergency in the North West by your employer;
4. your supervisor suffers a hear attack while reading your draft.

If you believe you have a case for a deferment, write a letter to the Head of Department before the Board of Examiners meets outlining your case. However, it has to be an exceptional case. Not having a back-up is NOT such a case. Further, any deferment will only be for a short time – days not weeks.
8.3 Changing projects

If you fail the first semester of project work you are required to select a new project. If you fail the second, then you have two options:

1. If your supervisor agrees your technical work was acceptable, you may re-enrol and write another thesis. That is, the problem was not so much technical as your thesis failed to communicate.

2. You may choose another project. HOWEVER, as you will have passed the first semester unit this means repeating all that work in your own time, then enrolling in the second project unit. If project is the only unit you have to complete, this work will have to be done in the vacation period as otherwise you would not be an enrolled student and so could not be given access to labs.

See the Projects Coordinator for details.

8.4 The Projects Coordinator

The Projects Coordinator is the unit controller for all BE undergraduate project units within the Department. The Course Coordinators are unit controllers for other project units.

The Projects Coordinator is responsible for managing the BE project units units, which means:

1. maintaining and issuing any project topics nominated by the academic staff;
2. generally managing industry-based projects;
3. keeping records of student supervisors;
4. maintaining documentation;
5. ensuring requirements are met;
6. ruling on particular project issues;
7. maintaining assessment records.

In addition, as the unit coordinator, the Projects Coordinator is ultimately responsible for all results. In practice, the Coordinator defers to assessments put forward by supervisors, but there is the responsibility to overrule any that are thought to be outside the spirit and regulations of project work.

8.5 Suggestions or complaints

Suggestions or complaints about resources for project work should be directed to the Projects Coordinator.
APPENDIX 1: A quick Guide to writing your draft thesis.

Step 1: The title and synopsis

List, say, 10 keywords that describe your work.

Select the most important and construct a sentence about it. This is your title.

Compose the rest into a paragraph. That is your synopsis/abstract.

Step 2: The index

Create a provisional index as follows:

1.0 Introduction
   1.1 Justification
   1.2 achievement
   1.3 layout
2.0 Background
3.0 Problem identification
4.0 Solution
5.0 Verification
6.0 Conclusions
References

Appendix 1: The project plan

Under each heading list the major bullet points you want to address or attach earlier prepared documents.

Now:

• Split each chapter into sections as seems appropriate.
• Select headings for each chapter, sub-section and sub-sub section so that overall it is clear from your index what has been done.

Step 3: Write

Write each section in one go. Then review it.

Write:

• in the third person;

• in the past tense as you are describing completed actions in the main;

• focus on the decisions you made that reflect on your engineering judgement as this is a justification of your efforts, not a report.
Appendix 2: Checklists for the presented thesis

These two checklists were derived by Rizky Farhan in 2006

Checklist for the Physical Thesis

<table>
<thead>
<tr>
<th>NO</th>
<th>TECHNICAL</th>
<th>TYPE Sub-Type</th>
<th>TECHNICALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overall</td>
<td>Spelling</td>
<td>Australian spelling</td>
</tr>
<tr>
<td>2</td>
<td>Printing</td>
<td></td>
<td>Laser or ink-jet</td>
</tr>
<tr>
<td>3</td>
<td>Paper</td>
<td></td>
<td>NO handwritten symbols or corrections</td>
</tr>
<tr>
<td>4</td>
<td>Paper</td>
<td>Size</td>
<td>A4</td>
</tr>
<tr>
<td>5</td>
<td>Paper Margins</td>
<td>Printing</td>
<td>Laser or ink-jet</td>
</tr>
<tr>
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<td>Top</td>
<td>2.5 cm</td>
</tr>
<tr>
<td>7</td>
<td>Paper Margins</td>
<td>Bottom</td>
<td>2.5 cm</td>
</tr>
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</tr>
<tr>
<td>9</td>
<td>Paper Margins</td>
<td>Right</td>
<td>2.5 cm</td>
</tr>
<tr>
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<td>Serif such as Times New Roman or times</td>
</tr>
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<td>Page Contents</td>
<td>Font Size</td>
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</tr>
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<td>Double spaced</td>
</tr>
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<td>Justified</td>
</tr>
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<td>Page Contents</td>
<td>Indentation</td>
<td>No indenting of text</td>
</tr>
<tr>
<td>15</td>
<td>Page Contents</td>
<td>Other Rules</td>
<td>No content between X.x and X.x.1 or similar, or between X.x.x and X.x.x.1</td>
</tr>
<tr>
<td>16</td>
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<td>Number from 1 to N, beginning from chapter 1 and including all appendices</td>
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Checklist for the Thesis structure

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<tr>
<td>1</td>
<td>Thesis is essentially about communicating the reasoning behind various engineering decisions made.</td>
</tr>
<tr>
<td>2</td>
<td>It shows my potential as an Engineer via elements of my key success</td>
</tr>
<tr>
<td>3</td>
<td>Describe technical activities</td>
</tr>
<tr>
<td>4</td>
<td>Definition of a paragraph: A paragraph must have a beginning, a development, and an end. Each paragraph must be able to stand independently</td>
</tr>
<tr>
<td>5</td>
<td>Final thesis must be based on an approved draft or it will not be assessed</td>
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Thesis Content Guide

<p>| | |</p>
<table>
<thead>
<tr>
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<tr>
<td><strong>Title</strong></td>
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<td>One Sentence for title; base on the most important keyword</td>
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<td>7</td>
<td>Expand Title</td>
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<tr>
<td>8</td>
<td>Explain what thesis is broadly about; use all keywords</td>
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<tr>
<td>9</td>
<td>One paragraph</td>
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<td>10</td>
<td>One line summary per heading</td>
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<td>Headings should summarise the content of the item under heading</td>
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<tr>
<td>12</td>
<td>Headings should be a clear one line statement</td>
</tr>
<tr>
<td>13</td>
<td>As a whole clearly define the structure of the thesis</td>
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**Thesis content**

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<table>
<thead>
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<tbody>
<tr>
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<tr>
<td><strong>INTRODUCTORY LETTER</strong></td>
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<tr>
<td>15</td>
<td>To the HOD offering the thesis to meet partial requirements for your degree</td>
</tr>
<tr>
<td><strong>ACKNOWLEDGEMENTS</strong></td>
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<tr>
<td>16</td>
<td>Acknowledge supervisor, and co-supervisor if assisted.</td>
</tr>
<tr>
<td>17</td>
<td>Acknowledge any technical support offered, or scholarship or similar support.</td>
</tr>
<tr>
<td>18</td>
<td>Do NOT acknowledge friends, God, etc. ONLY those who gave direct support such as editing.</td>
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<td><strong>INTRODUCTION (First to be read by examiners)</strong></td>
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<td>20</td>
<td>First part is to precisely define why the topic was worth investigating</td>
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<tr>
<td>from its importance and application in real life</td>
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<tr>
<td>Second part is stating why this is a singular piece of work</td>
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<tr>
<td>Third part briefly describe in few sentences, based on the structured index, the basic contents of each of the chapters</td>
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<td>What is expected in introduction:</td>
<td></td>
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<tr>
<td>Set the scene as it were</td>
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<tr>
<td>A set of arguments for undertaking this project</td>
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<tr>
<td>A project examines a small part of a big problem. Explain that big problem</td>
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<tr>
<td>Why is it important to solve that problem</td>
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<tr>
<td>Why is it important to undertake the project</td>
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<tr>
<td>Close the scene with: from that big problem, acknowledge the particular problem I am set to solve</td>
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<tr>
<td>Discuss briefly ( in part 2 ) on significant problems encountered, how the problems are tackled, and what is achieved</td>
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<tr>
<td>Define the environment in which the project was done</td>
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<tr>
<td>Clearly demonstrate understanding of the current practice and ideas defined in literature</td>
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<tr>
<td>Justify understanding of problem and concept, not just an elaborate explanation</td>
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<tr>
<td>The background should then be the basis to verify the solution I would be proposing in later chapters.</td>
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<tr>
<td>Focus on elements that are important to the solution</td>
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<tr>
<td>Must include references to show that I do understand the ‘state of the art’. Use these to back opinions expressed. Critique rather than list.</td>
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<tr>
<td>The title should be clear statement of what this is background to, not just the nebulous ‘background’. It should highlight the key issues</td>
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<tr>
<td>DETAILED PROBLEM STATEMENT</td>
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<tr>
<td>DETAILED PROBLEM SOLUTION</td>
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<tr>
<td>VERIFICATION OF THE PROPOSED SOLUTION</td>
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<tr>
<td>CONCLUSIONS (Third to be read by examiners)</td>
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<td>Analyse my work; is there a better way given my experience?</td>
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<td>Significant problems solved</td>
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<td>Significant part of project work / achievements</td>
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<td>Recommendation of future work</td>
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<td>Form as a chapter BUT no sub-divisions</td>
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<td>Use Chicago referencing ( see library web site ) or IEEE, but not both</td>
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<td>APPENDICES</td>
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<tr>
<td>Other appendices optional; use them to include material like source code, major drawings, large mathematical derivations, test results, etc that are relevant to the thesis but not relevant to the core body of the text</td>
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<tr>
<td>Place mass data – images, video, etc – on a CD. Attach the CD to the</td>
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back cover. Include an appendix describing the content of the CD plus the formats used

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<tr>
<td>48 Include a README giving your name, student number and program</td>
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