Writing an Honours Project Thesis

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1. Introduction

This short paper describes the basics of writing a good thesis. It should be read in conjunction with the many references listed below [1-10] and taking into account the advice of your supervisor. The format of this paper can also be used as a template for the 2 page, 2 column extended abstract that has to be submitted together with the thesis.

2. What is an honours thesis? For whom is it written? How should it be written?

In most cases, your thesis is a genuine technical report. The report concerns an engineering or scientific problem and it should describe what was known about it previously, what you did towards solving it considering the alternative approaches, and what you think your results mean.

A thesis is not an answer to an assignment question - there is a big difference. The reader of a student's assignment is usually the teacher who has set it. She/he already knows the answer (or one of the answers), not to mention the background, the literature, the assumptions and theories and the strengths and weaknesses of them. The readers of the thesis will not know what the "answer" is - usually your project is to discover something hitherto unknown.

More importantly, one of the readers (the examiner who is not your supervisor) will have at best only a basic idea of the relevant background, literature *etc.* Write for that reader - your supervisor will not be too bored while you explain things more fully: it is always interesting to read something about one's own field put into different words and it demonstrates your own understanding of the subject.

Your thesis will, of course, be read and marked, and then put away on a shelf in the School library. However it may also be used seriously in the future as a technical report, especially by future students working on related projects. Write your report with this audience in mind too.

3. Getting Started

Once you have a list of chapters and, under each chapter heading, a list of things to be reported or explained, you have struck a great blow against writers' block. It is at this stage that the main logical structure of the report has been hammered out. This process is similar to designing software, where the big problem is broken down into smaller manageable sub-tasks. (Divide and Conquer) When you sit down to type, your immediate aim is no longer to script an entire thesis at one sitting - a somewhat daunting goal - but something much simpler. You will start by writing the paragraph or section about one of your sub-headings. It helps to start with an easy one: this gets you into the habit of writing and gives self-confidence. Often the nitty-gritty Design/Materials and Methods is the easiest to write since you will be very familiar with your own work- just write down what you did. It is not usual to report this in chronological order: the order is determined by that which makes the description easiest to understand.

4. Adhering to standards

Use of units should conform with the SI units standard. A single space should appear between a number and the symbol for the units.

Graphical symbols conforming to appropriate standards (for instance IEE standards for electrical and electronic items) should be used The external examiner will look specifically for such details.

References should be made using the format seen in the references provided with this guide..

5. How much detail?

There should be more detail given than for a technical journal paper. Once your thesis has been marked, and your interested family have read the first three pages, the only further readers are likely to be people who are seriously doing research in just that area. For example, a future research student might be pursuing the same research and be interested to find out exactly what you did. ("Why doesn't the widget that Jones built for her honours project work any more? Where's the circuit diagram? I'll look up her thesis." "Evan's subroutine doesn't converge in my parameter space! I'll have to look up his thesis.") It is traditional to include diagrams such as experimental set-ups or printed circuit board layouts and computer programs, usually as appendices. Ideally, programs should be intelligibly annotated or commented but this practice sadly does not happen very often.

You have probably read the theses of previous students in the laboratory where you are now working, so you probably know the advantages of a clear, explicit thesis and/or the disadvantages of a vague one.

6. Make it clear what is yours.

If you use a result, observation or generalisation that is not your own, you must usually state where in the scientific literature that result is reported. The only exceptions are cases where every engineer knows it: Maxwell's equations need not precede a citation of Maxwell, circuit analysis doesn't need a reference to Kirchoff, fluid equations do not need a reference to Bernoulli or beam equations to Euler. The importance of this practice in engineering science is that it allows the reader to verify your starting position. Engineering and Physics are said to be a vertical sciences: results are built upon results which in turn are built upon results... Good referencing allows us to check the foundations of your additions to knowledge, or at least to trace them back to a level which we judge to be reliable.

Good referencing also tells the reader **which** parts of the thesis are descriptions of previous knowledge and **which** parts are **your additions** to that knowledge. In a thesis, written for the general reader who has little familiarity with the literature of the field, this should be especially clear.

It may seem tempting to leave out a reference in the hope that the non-specialist reader will think that a nice idea or a nice bit of analysis is yours. I advise against this gamble. The reader will probably think: "What a nice idea - I wonder if it's original?". If the reader has to spend a few hours in the library to find out, then she/he may not be in a great mood to read the rest of the thesis.

The work that is actually yours may be only a small part of the whole thesis, especially in a non-numerical theoretical thesis. Do not feel bad about this: all of us who work in engineering or science know that one has to do a lot of work just to get to the boundary between the known and the unknown, and that any small advancement of that boundary is an important achievement.

If you are writing in the passive voice, you must be more careful about attribution than if you are writing in the active voice. "The sample was prepared by heating yttrium..." does not make it clear whether you or someone else did this. Unless you use a reference, it will be assumed that you are claiming to have done the work.

7. Presentation.

It must be easy to read, so typing is preferable to handwriting. There is no need, however, for the finished product to be a masterpiece of desk-top publishing. Your time can be more productively spent improving the content than the appearance. In many cases, a reasonably simple neat diagram can be a great aid in clearly explaining something. ('A picture is worth a thousand words.') Make the points and explanations clear, avoiding long convoluted sentences! Think more about the significance of what is being said, the reader should not have difficulty in following your line of reasoning, or in seeing the significance of what he/she is reading in relation to the whole project! Check for errors in the algebra and calculations, the examiner will!

There is no strong correlation (positive or negative!) between length and mark. Readers will not appreciate large amounts of vague, irrelevant or unnecessary text (*i.e.* avoid padding). There is no need to leave big gaps and empty pages or to use cardboard sheets to make it thicker. (We sometimes see this).

The text must be clear. Good grammar and well thought out writing will make the thesis easier to read: it should read smoothly, with a flow. Try to link the sections together so that the thesis does not read as if different parts have been written in isolation and just bolted together to make up a report. Be careful that cross-referencing of sections, figure and equation numbers are accurate and consistent. Avoid sudden inexplicit changes of subject; the logical structure behind the arrangement of the material should be clear. Technical writing has to be a little formal - more formal than this text. Native English speakers should remember that scientific or technical English is an international language. Slang and informal writing will be harder for a non-native speaker to understand and has no place in formal reporting.

One common convention is to use the passive voice. The active voice ("I measured the frequency...") is simpler, but is not used because personal pronouns, such as "I", "we", are to be avoided in practise. The passive voice ("The frequency was measured...") is more difficult to master, making it all too easy to write ungrammatical or awkward sentences. Do read well-written textbooks and papers in the relevant journals, such as the IEE and IEEE Proceedings. This will give you familiarity with the style of writing which has become the norm in serious technical reporting. The references below [1-10] will provide further help on the subject.

The layout and structure are described in more detail in a separate paper [9].

**8. References**

1. Booth W.C., The Craft of Research, University of Chicago Press, 1995.

2**.** Eisenberg A.**,** Effective technical communication**,** McGraw-Hill, 1992**.**

3. Fisher E., Enjoy Writing your Science Thesis or Dissertation!: a step by step guide to planning and writing dissertations and theses for undergraduate and graduate science students, Imperial College Press, 1999.

4. Kirkman, A.J., Good Style: writing for science and technology, Chapman & Hall, 1992.

5. Kirkman A.J., Full Marks: Advice on Punctuation for Scientific and Technical Writing, Ramsbury Books, 1993.

6. Lindsay D., A Guide to Scientific Writing, Longman 1995.

7. Shortland M., Communicating Science, a Handbook, Longman 1991.

8. Silyn-Roberts H., Writing for Science: a Practical Handbook for Science, Engineering and Technology Students, Longman, 1996.

9. Towers M.S. & Bonet J., “Layout and structure of level 3 Project Thesis”, School of Engineering, 2007.

10. Van Emden J., Handbook of Writing for Engineers, Macmillan Press, 1998.