MACQUARIE UNIVERSITY ~ SYDNEY

Division of Information and Communication Sciences

DEPARTMENT of PHYSICS

GUIDELINES FOR LABORATORY REPORT WRITING

Report writing is a generic skill which you will need in your future employment. You have the opportunity to develop this skill through laboratory report writing in the physics and optoelectronics units in which you are enrolled. Examples of well written reports that received high assessments are something you could show potential employers.

First you must complete the experiment. It is very important that adequate time is spent reading and understanding the experiment notes (and references) at the outset. It will be much easier to report an experiment undertaken with a clarity of purpose. Students are required to keep a complete, intelligible record of their practical work. All measurements, observations, calculations and other relevant information must be recorded in a single laboratory notebook. Loose sheets of paper are not acceptable. Your laboratory notebook will be checked during and/or at the end of semester. You may be required to append a copy of the relevant pages from your laboratory notes to a report at the time of submission.

The layout of a report is not rigid, but a suitable format has evolved over many years and may be seen in articles in journals such as the American Journal of Physics. The layout below is a guide for good laboratory reports. However, there is no substitute for your own judgement in reporting your results. Developing your judgement should be one of your aims in your report writing.

Experiments in physics and optoelectronics increase in sophistication and in physics they also increase in length as you progress from first to third year. This should be reflected by increasing sophistication in your reports. A typical optoelectronics report is about 3-6 pages long handwritten or the equivalent typed (excluding diagrams, tables etc.). A typical third year physics report is about 8-15 pages handwritten or the equivalent typed. Most reports are typed. You will get further advice of what is expected in individual units from the laboratory supervisor.

Layout for a Laboratory Report

TITLE
Your Name
Your Partner's Name
Date(s) of Experiment

1. Summary or Abstract

This is not absolutely essential, but certainly desirable. This is usually the last section written, but should head the report. It should briefly explain what the experiment is about, and give a concise summary of the results and their significance. In the real world it will be the only section read by most readers, so it must be clear.

2. Introduction

This contains the background to, and aims of the experiment or set of experiments. The background to the work needs to be clearly described in the context of existing knowledge (giving references if appropriate). For example some experiments have historical significance, e.g. Millikan oil drop, speed of light, photoelectric effect, and this would be described in the introduction in addition to the physical significance of the experiment. Others will be adequately introduced by a description of a physical phenomenon and why it is important. The introduction should normally be no more than 20% of the total report in length.

3. Theory

This section should include all theoretical relations which will be used to interpret your results in later sections. Omit derivations of standard formulae, but if you develop an equation into some other form to fit your analysis, then include the development.

4. Method

Describe the experiment, produce and refer to figures of the experimental layout, electrical circuits, etc., as necessary. Each figure must be numbered and have an accompanying figure caption. List important apparatus. Do not reproduce the laboratory manual/notes. Give a reference to these in your report as seems appropriate, particularly for 100 level physics courses. You may like to attach a copy of the laboratory notes to the back of your report for future reference.

5. Results and Uncertainties

This is where you put your data, without any significant analysis. It is not necessary both to tabulate and to graph data; one or other (preferably a graph) is sufficient. Graphs should be labelled, and units and uncertainties always included. Data should not normally be put in an appendix. You always have your laboratory log book as evidence of your original measurements if these are ever required. All experimental values should have uncertainties attached, and units where appropriate. State results for quantities measured and refer to equation numbers in which the quantities have been mentioned (see theory section).

6. Analysis of Results / Discussion

Analyse, interpret and discuss each result in some detail. This should include a discussion and sensible analysis of the random and systematic errors. Compare with theoretical expressions and known values where appropriate. Discrepancies must be adequately addressed, not just noted. e.g. Where there is a predicted linear relationship in data, is this validated by your results?

7. Conclusion

This is not just a rehash of the summary. Try to take an overview of the experiment, where you've reached, and where further investigation might be warranted. Avoid stock phrases like "The results agreed with theory within the limits of experimental error".

8. Acknowledgements, if applicable

Those who have contributed to the work deserve to be acknowledged.

9. References

Give full details of references used and referred to in preparing your report.

e.g.

1. R. Resnick, D. Halliday and K.S. Krane, (1992), Physics 4th ed. (Wiley: New York) p. 55.
2. J.P. Gordon, H.J. Zeiger and C.H. Townes, "The maser - new type of microwave amplifier, frequency standard, and spectrometer", Phys. Rev. **18**, 1264-1274 (1955).

10. Appendices

In a long report some material may need to be included which would affect its readability, e.g. a long derivation of an equation for which no adequate reference can be found, a listing of a computer program written to assist in analysis of data. These should be included as appendices.

Report Deadlines

Aim to submit your reports several days before the due date. Deadlines are carefully chosen for the convenience of both students and staff, and correspond to the latest date for submission without penalty; they are NOT dates around which you should try to submit. Late reports may incur a penalty of up to half marks for being up to 1 week late (consult individual course supervisors). Reports submitted more than 1 week late may not be marked, though submission may still be required to satisfy the formal requirements of the course unit. Late penalties may be waived in cases of illness or misadventure. Normal pressures of employment and university work are not acceptable grounds for late submission of lab reports.

General Notes

(i) The style of the report should be concise, formal, and written in the past tense. This is the style most appropriate to written reports in any scientific or technical environment. Your sentences should present ideas in a logical sequence. Do not give instructions (e.g. write ‘A was c
rather than ‘Connect A to B’). Paragraphs should be used to introduce new topics. You are also expected to write legibly, with good grammar, and spell accurately. You should proof-read reports.

(ii) The use of a word processor is certainly encouraged but by no means necessary. Diagrams, circuits and graphs should only be computer generated if the detail can be as complete as those drawn neatly by hand. Elaborate presentation is neither required nor encouraged, clarity in your writing and presentation is your main aim.

(iii) Where a report is short it is reasonable to combine two or more sections under one heading, e.g. Results and Discussion.

(iv) There may be relevant non-numerical observations which you should report, possibly as an additional observations section between methods and results. These might include values changing in time, transient effects, the effect of vibrations, etc.

Assessment

Markers will award integral marks up to 10 (5) using the following as a guide:

0 (0) marks	Little of the set work was done, and that was incompletely and illegibly reported.
1 - 2 (1) marks	Not much of the set work was done, and that was reported incompletely or illegibly.
3 - 4 (2) marks	Much of the set work was done, but the report was unacceptable because it failed to compare experiment with theory or was incomplete or illegible or lacked proper treatment of uncertainties.
5 - 7 (3) marks	Most of the set work was done. However the report revealed some gaps in the student's understanding, and/or missed obvious comparisons of experiment with theory, and/or was incomplete or illegible, and/or treatment of uncertainties was inadequate.
8 - 9 (4) marks	Almost all of the set work was done, and the report indicated that the student understood what was going on, and successfully compared experiment with theory when requested, producing a complete and legible report.
10 (5) marks	While meeting the requirements for 9 marks, the student showed real initiative, e.g. by making comparisons of experiment with theory which were not requested, by carefully investigating an unexpected result, by making comments which indicate real insight, or by producing an exemplary report.

Useful References

Further information on scientific and technical report writing can be found in numerous books on the subject. Some references are suggested below.

1. Les Kirkup, (1994), *Experimental Methods*, (Wiley: Brisbane), Ch. 7. (Library call number QC37.1557).
2. Pamela Peters (1985), *Strategies for Student Writers: a guide to writing*, (Wiley: Milton, Queensland). (Library call number PE1471.P42).

PLAGIARISM

(http://handbook.mq.edu.au/p3/pt3d_106.htm)

The Academic Senate in September 1992 adopted the following definition of plagiarism.

Plagiarism involves using the work of another person and presenting it as one's own. Any of the following acts constitutes plagiarism unless the source of each quotation or piece of borrowed material is clearly acknowledged.

a. copying out part(s) of any document or audio-visual material (including computer-based material);
b. using or extracting another person's concepts, experimental results, or conclusions;
c. summarising another person's work;

d. in an assignment where there was collaborative preparatory work, submitting substantially the same final version of any material as another student.

Encouraging or assisting another person to commit plagiarism is a form of improper collusion and may attract the same penalties which apply to plagiarism.

Senate also approved a statement entitled *The Dangers of Plagiarism and How to Avoid it* which is as follows:

The Dangers of Plagiarism and How to Avoid it

The integrity of learning and scholarship depends on a code of conduct governing good practice and acceptable academic behaviour. One of the most important elements of good practice involves acknowledging carefully the people whose ideas we have used, borrowed or developed. All students and scholars are bound by these rules because all scholarly work depends in one way or another on the work of others.

Therefore, there is nothing wrong in a student using the work of others as a basis for their own work, nor is it evidence of inadequacy on the student's part, **provided they do not attempt to pass off someone else's work as their own**.

To maintain good academic practice, so that a student may be given credit for their own efforts, and so that their own contribution can be properly appreciated and evaluated, they should acknowledge their sources and they should **always**:

i. state clearly in the appropriate form where they found the material on which they have based their work, using the system of reference specified by the Division in which their assignment was set;
ii. acknowledge the people whose concepts, experiments, or results the students have extracted, developed, or summarised, even if they put these ideas into their own words;
iii. avoid excessive copying of passages by another author, even where the source is acknowledged. Find another form of words to show that the student has thought about the material and understood it, but stating clearly where they found the ideas.

If a student uses the work of another person without clearly stating or acknowledging their source, the result is falsely claiming that material as their own work and committing an act of **PLAGIARISM**. This is a very serious violation of good practice and an offence for which a student will be penalised.
A student will be guilty of plagiarism if they do any of the following in an assignment, or in any piece of work which is to be assessed, **without clearly acknowledging their source(s) for each quotation or piece of borrowed material**:

a. copy out part(s) of any document or audio-visual material, including computer-based material;
b use or extract someone else's concepts or experimental results or conclusions, even if they put them in their own words;
c. copy out or take ideas from the work of another student, even if they put the borrowed material in their own words;
d. submit substantially the same final version of any material as a fellow student. On occasions, a student may be encouraged to prepare their work with someone else, but the final form of the assignment must be their own independent endeavour.

oOo *9/2002*