

FACULTY OF ENGINEERING
CO-OP WORK STUDY PROGRAMS
REPORT WRITING MANUAL

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ENGINEERING WORK TERM REPORTS

1.0 INTRODUCTION

The stated purpose of Co-Op education is the marrying of academic knowledge and practical experience gained on the job. Note - it is not to increase academic knowledge, although that may be an unforeseen bonus. Instead, it is to give greater meaning to that already attained, and/or what will be attained in the future.

The purpose of the work term report exercise is to have the students demonstrate their ability to select a topic and to gather, select, collate, organize and present information towards the report's topic and purpose. This must be done in a professional-looking, well-written, easily understood fashion, using correct English and grammar. The reports themselves represent a formal communications exercise, preferably emanating out of the work term environments and activities the students have experienced.

The audience for your report will be your marker, who will be an Engineering faculty member, and your peers. Write your report at a technical level that is understandable to your audience, i.e. a reader who has an engineering background but who may not be familiar with your work. Your audience has not worked at your company, and will probably not be familiar with the acronyms and local jargon used at your work place. Make sure that you define all acronyms and terms that are not commonly used. A glossary placed at the end of the report can assist the more general reader without hampering the readability of your report.

Writing style, spelling, punctuation and the report format are very important. If you feel you need information on writing style, read one of the recommended texts listed in the reference section at the end of the guidelines. You will probably notice that the format described in these guidelines differs from that which your company uses. Until report formats are standardized across all businesses, we recommend these guidelines for your work term report. If this conflicts with your organization's requirements, please call the Director, Co-op Work Study programs. For most writers, a reasonable length is 10 - 15 pages for the main body of the report when following the format described below.

The work term report is an analytical engineering report. It is more than just a technical description. It outlines how information was applied to solve an engineering problem. The problem may be one which you worked on directly or assisted with. It may be a problem that fellow employees are working on and that you are interested in. Choosing a topic and developing the report content can be the most difficult part of writing the report.

2.0 THE TOPIC

The selection of a topic is a major concern to many students, but, in fact, it is not nearly as important as the manner in which the subject matter is treated. If a student is in a challenging work term position, and/or in an interesting environment, regardless of the industry, it is most likely that a suitable topic can be found relating to it.

The report need not be related to a research project, although that would be very acceptable. It need not relate to a technical project, although that would be highly desirable, and it need not come from working in a technical capacity, or in a technical industry, although they too would be very desirable. Clearly, a topic and industry related to your major and year of study is the most desirable, but when they are not, whatever topic is selected need not detract from preparing a very good work term report.

Students may develop software or procedural manuals as a work term project. These, by themselves, are not suitable as a work term report. Instead, a report on the background and development of a particular software/manual would be very suitable, and the software or manual itself would fit as a suitable appendix.

Some examples of topics that could be very acceptable, given that they are supported by suitable report content, follow.

- The evaluation of the process control requirements of a particular production process.
- The evaluation of the material flow or plant layout of a particular industrial operation.
- An analysis of the business control aspects of a particular operation, and its interaction with the production activities.
- The identification and evaluation of certain systems within a company or larger organization. These may be such things as the interaction of operational control, process control and financial control systems.
- An evaluation of the environmental considerations in relation to a company's products, processes or facilities.
- A documentation and evaluation of the project management organization and activities related to a specific project.
- A documentation and evaluation of the formal and informal organization and activities related to a specific project.

- A documentation and evaluation of the formal and informal professional, personal, and technical development of new engineering graduates in a particular company during their first five years of employment.
- A critique of contracting practices and documents utilized by a certain company or project.
- A report on the design and development of a certain product, process, or piece of one.
- An assessment of a particular production process or methodology.

The easiest way to write a coherent report is to have a topic, then develop a central issue about the topic. Any material presented in the report should be relevant to the central issue. An example of a topic could be the adoption of a new CAD system. Rather than simply including a lot of unconnected information about the system, an issue could be why the change is needed. Any information introduced in the report should relate to why the change is needed. The introduction would include enough information to allow the reader to understand existing problems (e.g. how the original drawing system works, difficulties when trying to update/access drawings). The requirements for the new system could then be introduced (e.g. cost savings, speed, ease of use), then a discussion on which system was chosen and why it was chosen would follow. Your conclusions could be that the best system was chosen (based on cost, ease of use, speed, availability, etc.) and you could recommend ways to overcome some of the compromises made (e.g. purchasing a plotter at a later date to reduce up front costs). By having an issue, the report will follow a logical flow and assist the reader to understand the issue.

Where possible, include numbers and reference material to support your statements. For example, stating that “adding a colour printer is not feasible due to costs”, is not as convincing as including a table of price quotes from potential suppliers.

3.0 WORK TERM REPORT DESIGN

There are five areas that you should consider preparing your work term report:

1. The audience
2. The treatment of the topic
3. The format of the presentation
4. Writing and communication
5. Timing

3.1 The Audience

The typical audience for almost all engineering reports in industry and business, with the exception of research reporting, is “an educated, non-technical person or group”. As such, the presentation of charts, graphs and data to support the analysis and presentation should be carefully planned so as to add clarity rather than confusion. Detailed or complex calculations, if included at all, are usually best placed in an appendix.

3.2 The Treatment of the Topic

The purpose of almost all reports in business and industry is to provide a background and basis for making a decision. It follows that there needs to be some background information that frames the topic, a presentation of the issues to be dealt with, some analysis of the relevant factors and/or data, and some conclusions and recommendations. Clearly, the expectation is that the content will demonstrate an effort and proficiency level consistent with your year of study. Much more is expected in the fourth work term than in the first.

3.3 The Format of the Presentation

A suggested format is outlined in the next section.

3.4 Writing and Communication

First and final impressions of the substance of a report are influenced in a major way by the image imparted through the style and level of the writing. Brilliant technical work can be submerged by poor English and presentation. Similarly, the image of ordinary technical work can be enhanced by thoughtful presentation and communication.

The well rounded engineer is one who is a good communicator as well as a sound designer, analyst, etc. Further, the importance of being a good communicator increases as one's career progresses, and it is important that this development receives appropriate priority. The focus on "communication" in the work term report is a reflection of this importance.

3.5 Timing

In industry and business, a late report, beyond the time it was required to help make a decision, is a useless document! No marks are given for effort. Scorn, resentment and the impression of unreliability is the real consequence. Planning and organization are required to ensure that reports are completed "on time".

The best time to prepare the work term report is while you are still on the work term. This will permit ready access to people and surroundings as a source of guidance and information. If that is not practical, you should, at minimum, while still on the job site, select a topic and do sufficient information gathering and organizing to be able to develop a fairly detailed table of contents as the skeleton of the report.

4.0 WORK TERM REPORT CONTENT

Include the following items in your report, in the listed order:

- Cover
- Letter of Transmittal
- Title Page
- Table of Contents
- List of Tables and Figures
- Executive Summary
- Introduction
- Discussion
- Conclusions
- Recommendations
- References
- Glossary (optional)
- Appendices (optional)

The purpose of the preceding items are briefly described below. These criteria are specific to Faculty of Engineering Work Term Reports; for general information on the structure of a formal report, refer to Blicq (1987), Beer and McMurrey (1997), or Buckley (2003).

4.1 The Cover

The report will be contained in a cover which binds the pages (e.g., a duotang or a flexible 3-ring binder) but still allows the pages of the report to lie flat. The cover should indicate the title of the report and your name.

4.2 Letter of Transmittal

The letter of transmittal not only introduces the report, but also explains its purpose and scope and outlines the major recommendations. Your contribution to the overall project and acknowledgements of others should also be included.

The letter of transmittal precedes the title page. It is a letter included with the report and, as such, has no page number. Use a standard business letter format, address the letter to the Director, Co-op Work Study Programs, and include your signature at the end. Do not use company letterhead - this report is an academic requirement for a registered class, and should be from you, in your role as a student.

The letter of transmittal should contain the following information on one page:

- The title of the report
- Your work term number (ENGG 051, ENGG 052, etc.)
- The name and location of your employer
- The main activity of your employer
- Your project or area of work
- The scope of the report, i.e. what facets of the problem are discussed
- Disclaimers, special problems encountered, or extenuating circumstances, if applicable
- Acknowledgements of helpful people, groups or organizations
- Any other features that may be of interest to the reader.

4.3 The Title Page

The title page announces your report to the reader. As an announcement, it should be descriptive of the report content and understandable to the general reader. Terminology specific to your company and uncommon acronyms should be avoided in the title.

The information required on the title page is:

- The report title, generally relatively short, say no longer than 120 characters
- Your name, SID, engineering program and work term course number
- The date you submitted the report

The title page is not numbered.

4.4 The Table of Contents and the List of Tables and Figures

The Table of Contents allows the reader to find the location of a specific section or illustration. It is constructed from the major headings used in the report. Note that the appendices are listed at the bottom of the Table of Contents and that a List of Tables and Figures follows on the subsequent page.

4.5 The Executive Summary

The executive summary or abstract is written for the general reader who wishes to be familiar with the content of the report while avoiding technical details. The summary is a separate report, stating the engineering problem, the approach to the solution, the main results and the recommendations. Items in the main report such as tables, figures or sections, are not referred to in the summary. It is normally prepared after the report is completed.

The summary is normally presented centered on its own page, single-spaced, and is less than one page in length.

4.6 The Introduction

The introduction introduces the report to the reader by:

- introducing the subject to be discussed
- explaining why the subject is important
- outlining the content of the rest of the report
- containing sufficient background information for the reader to understand the rest of the report.

Introductions should never be longer than the discussion. If a significant amount of background information is required, some of the material may be included as appendices.

The introductory material may be presented in several sections to cover the scope of the report as well as provide the necessary background information.

4.7 The Discussion

The discussion is the foundation of a report. It presents evidence in the form of referenced facts, data, test results, and analysis upon which the conclusions are based. A well written discussion flows logically from concept to concept to lead the reader to the appropriate conclusions.

Methodology and Analysis

Methodology is the process you have chosen to gather or analyze data necessary to your analysis. A brief statement as to the methodology chosen and why it was chosen provides the basis for the reader's understanding of your analysis.

The nature of this section will depend on the discipline. Usually, analysis requires the manipulation of data, interpretation of data, and/or the evaluation of alternatives you considered in order to provide a solution to the problem or issue you identified in the introduction.

In evaluating alternatives, ensure that you itemize the advantages and disadvantages of each alternative being looked at. Quantification of these advantages and disadvantages assists in the evaluation. However, often you may not be able to quantify them, and therefore the evaluation will take on a more subjective nature.

The discussion may contain several sections if several concepts are presented.

4.8 The Conclusions

Conclusions are the results derived from the evidence provided in the discussion. No new material is presented in the conclusion.

When presenting more than one conclusion, state the main conclusion first followed by the others in the order of decreasing importance, to ensure the maximum impact on the reader.

4.9 The Recommendations

If recommendations are appropriate, they will be the choice of the best alternative based on your analysis. The reasons for that choice form the basis for your recommendations. In some cases, your report will not require recommendations. This may be the case if your topic is limited to analysis of data that requires only conclusions to be drawn.

If your project involves the evaluation of a program, policy or procedure, your recommendations outline future courses of actions that have been analyzed as being superior to other avenues. You should also summarize why these actions are superior to other alternatives.

4.10 References

Any information quoted, paraphrased, or summarized is cited as a reference. Citing references assists the reader by indicating where further information can be found, and lends credibility to the analysis within your report.

Any material introduced in the report that is not your original work should correspond to an item in the List of References. The material cited may be tables or figures from other sources, equations which you did not derive, technical specifications or facts used to support your claims.

Wikipedia is not acceptable as a cited reference. As an engineer, your work must be based on reputable and reliable sources, which are consistent over time.

4.11 The Glossary

The glossary and list of symbols are optional items used to provide a quick reference to the reader.

The glossary defines specialized technical terminology including acronyms, listing them in alphabetical order, while the list of symbols defines the mathematical symbols used in the report. Any mathematical symbols or constants included in the report should be defined since most mathematical usage is not standardized.

Glossaries and lists of symbols are useful when a large number of terms must be introduced in the report.

4.12 Appendices

Any data supplementary to the main ideas of the report may be placed in an appendix. The information may be a description of the processes involved, analytical proceedings, computer printouts, technical specifications, or excerpts from other reports. Any type of information may be placed in an appendix if it is relevant, provided it is referred to in the main report. If you wish to include drawings and hand calculations in your appendices, use copies, not originals.

An appendix refers to one set of information. If several sets of information are to be included, several appendices may be used. Appendices may be referred to by letter (Appendix A, B, etc.) or by number (Appendix I, II, III, or 1, 2, 3, etc.).

Page numbers in appendices are hyphenated, e.g. A-1, B-12, etc. In the Table of Contents, appendices are listed at the bottom with no page reference to avoid redundancy, since the first page of Appendix A would be A-1, and the first page of Appendix B would be B-1, etc.

5.0 OVERALL FORMAT

Pages are printed single-sided in an easy to read font and font size 11 or 12. Line spacing should be at least a line and a half.

5.1 Page Numbering

Except for the title page and letter of transmittal, all pages are numbered. Front matter - the sections preceding the Introduction (Table of Contents, List of Tables and Figures, Executive Summary, and the Glossary)- are numbered using lower case Roman numerals, i.e, i, ii, iii, iv, etc.

Page numbers may be placed at the top middle, top right hand corner, bottom middle or bottom right hand corner of the page. The location of the page numbers should be the same throughout the report to avoid confusion.

Appendices are numbered separately from the rest of the report usually by appendix designation followed by the page number, e.g. A-1, A-2, B-1, etc. or I-1 I-2, II-1, etc.

5.2 Section Numbering

Many engineering reports number the sections of the report as a convenient organization tool. You may number sections in the report using a numerals-only system. Headings can either be left-justified or indented for each layer (Table 1). Each section should contain at least one paragraph, several sentences long, with no more than 3 sections per page.

Left-justified	Indented
1.	1.
2.	2.
2.1	2.1
2.1.1	2.1.1
3.	3.
3.1	3.1

Table 1 - Illustration of possible section numbering systems.

5.3 The Use of Headings

Every section in the report has a heading. A heading briefly describes the section that follows and is most often followed by a paragraph rather than

another heading. Section and sub-section headings are used in the Table of Contents to assist the reader in locating specific material in the report.

5.4 The Use of Tables and Figures

Tables and Figures illustrate information in an easily understood format. They may be included in the main sections of the report, or if they contain supplemental material they may be contained in an appendix.

Use the following conventions to assist the reader:

“Test results are summarized in Table 3.”

“Output was proportional to input (Figure 12)”

Place the table/figure after it is first referred to in the text. If the information is not your own, cite the reference at the end of the title, e.g. Figure 1: Network Design (Cornelio, 2003). Wherever possible, try to orient illustrations in the same direction as the main text.

5.4.1 Numbering Tables and Figures

Tables and figures are numbered separately, e.g. Table 1, Table 2, Figure 1, Figure 2. Refer to the List of Tables and Figures in the sample report, Appendix I.

Illustrations must be numbered sequentially through the whole report (e.g. Table 1, Table 2, Table 3, Table 4).

5.5 Reference Format

We recommend the APA style, as described in the University of Waikato APA Reference Guide. A link to this guide is available on the University of Regina Engineering Co-op WebCT site.

The format for the most commonly used types of references is illustrated below (University of Waikato, 2007).

A book with one author

REF LIST	IN TEXT
Chunn, M. (1997). <i>Seven voices: Tales of madness and mirth</i> . Auckland, New Zealand: PEP.	(Chunn, 1997).

Conference Paper

REF LIST	IN TEXT
Field, G. (2001). Rethinking reference rethought. In <i>Revelling in Reference: Reference and Information Services Section Symposium, 12-14 October 2001</i> (pp. 59-64). Melbourne, Victoria, Australia: Australian Library and Information Association.	(Field, 2001).
N.B. Conference name is in capital letters.	

Report

REF LIST	IN TEXT
Smith, P. (2001). <i>Waikato River water quality monitoring programme: Data report 2001</i> . Hamilton, New Zealand: Environment Waikato.	(Smith, 2001).

Journal - Print Version

REF LIST	IN TEXT
Cornelio, A. (2003). Promoting information literacy through information architecture. <i>Library Media Connection</i> , 21(6), 24-26.	(Cornelio, 2003).

Website (multiple pages - reference the homepage!)

REF LIST	IN TEXT
American Psychological Association. (2003). <i>APA style: Electronic references</i> . Retrieved October 7, 2004, from http://www.apastyle.org/eleceref.html	(American Psychological Association, 2003). N.B. Do not write URLs in the text

Course Handouts/Printed Lecture notes

Put the format in square brackets - e.g. [Handout] [Lecture notes] [PowerPoint]

REF LIST	IN TEXT
Brown, P. (2004). <i>Marketing</i> [Handout]. Hamilton, New Zealand: University of Waikato: Diploma in Marketing.	(Brown, 2004).

Standards

REF LIST	IN TEXT
Standards Association of Australia. (1997). <i>Australian standard: Pressure equipment manufacture</i> . AS4458-1997. North Sydney, NSW: Author.	(Standards Association of Australia, 1997).

Personal Communication (Letters, Telephone conversation, Emails, Interviews, Lecture notes etc.)

REF LIST	IN TEXT
No information is required in the reference list. Data is not recoverable so do not include in reference list.	(H. Clarke, personal communication, March 19, 2004). In his lecture on 19 March 2004, Professor Clarke commented that...

When citing a reference within the report, place the reference

- at the end of a sentence just before the period, e.g. (Chun, 1997).
- after figure and title labels, e.g. Figure 1: Network Design (Cornelio, 2003)
- after the appendix title if the entire appendix is copied from another source, e.g. Appendix A (Smith, 2001)
- at the right hand margin beside a mathematical equation.

In the List of References, list the cited references in alphabetical order. The Bibliography is listed separately, also in alphabetical order.

6.0 Closing Remarks

The above guidelines are a condensed version of the material covered in the books listed in the References. Refer to the recommended texts for more detail. If you have any further questions or comments, contact the Director, Co-op Work Study Programs.

6.1 Work Term Report Evaluation

The work term reports are evaluated by Engineering Faculty members. A sample Work Term Report Evaluation Form can be found on the Engineering Co-op WebCT site.

7.0 List of References

Beer, David and David McMurrey. (1997). *A Guide to Writing as an Engineer*. Toronto, ON: John Wiley & Sons Inc.

Blicq, Ron S. (1987). *Technically-Write!* Scarbouroug, ON: Prentice-Hall Canada Inc.

Buckley, J. (2003). *Checkmate: A Writing Reference for Canadians*. Scarborough, ON: Nelson

University of Waikato. (2007). *APA Reference Style*. Retrieved June 26, 2008, from http://www.waikato.ac.nz/library/learning/g_apaguide.shtml

8.0 SAMPLES

This material has been taken from actual Engineering Co-Op reports. Names have been changed.

8.1 SAMPLE LETTER OF TRANSMITTAL

2355 Francois St.
Regina, Saskatchewan
S4N 2Z2

May 13, 2008

Dr. Marie A. Iwaniw, P. Eng.
Director, Co-Op Work Study Programs
Faculty of Engineering
University of Regina
S4S 0A2

Dear Dr. Iwaniw:

This workterm report, entitled 'Trials of a Network Administrator' was written for my second workterm which was at Western Economic Diversification (WED). WED is a government department that is across Western Canada. My office was in Winnipeg. The Winnipeg office creates economic growth in the Manitoba region. WED helps clients diversify the Manitoba economy with new industries like computers, aerospace, and manufacturing. My job was to be a network administrator and to solve any computer troubles the office experienced. In addition, I also built servers for their new network and helped upgrade existing machines and hardware.

This report explains the type of decisions a network administrator makes when running a network. Most of the concepts and approaches I experienced first hand. I would like to thank my supervisor Mark Patel, head of IT infrastructure support, for spending hours teaching me about the network and answering thousands of questions. Also, thank the Novell Netware Helpline for valuable information needed to write this report and to learn how to solve network problems. And finally to Mark Grover and Mike Santini for their knowledge about networks and assistance in making network decisions.

Your truly,

<signature required>

Paul Bester

8.2 SAMPLE TABLE OF CONTENTS-SECTIONS NUMBERED

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8.6 SAMPLE GLOSSARY

Analog Output Module:

A PLC module capable of providing an analog (e.g. 0 to 10 V or 0 to 10mA) voltage or current signal to a circuit. The module converts a digital value from the PLC bus to a voltage or current signal on the electrical terminals.

Analog Input Module:

A PLC module that converts an incoming analog signal (voltage or current) to a digital value which can be read by the processor module.

Contact sense:

Relay contacts can be either normally open (N/O) or normally closed (N/C). The “normal” condition refers to the state when the contacts’ associated coil is de-energized. When the coil is energized, normally open contacts will close and normally closed contacts will open. When the coil is de-energized again all the contacts will return to their normal state.

EEPROM:

Electrically Erasable Programmable Read-Only Memory is a type of ROM that can be erased and rewritten by a PLC without special equipment.

Electric Motor Starter:

A starter is a device designed to provide power to a motor. It consists of a relay which closes contacts in the three phase lines running to the motor. These contacts are in series with overload relays allowing the overload to shut down the motor. Newer electronic “smart starters” are capable of special functions including “ramping” the input voltage until the motor reaches operating speed so that starting torque and current are limited.

Programmable Logic Controller (PLC):

Also called a programmable controller is a type of computer designed for application in an industrial environment. This device has special I/O capacity and its own control programming language usually in the form of ladder logic.

Ladder Logic:

A type of code which is used to program PLCs. This language has most of its roots in electrical control diagrams, relays and Boolean algebra.

LAN:

Local Area Network is a digital communications system that usually employs a shield twisted pair to connect its nodes, an electronic device containing a printed circuit board and electrical terminals and is installed in a PLC chassis.

Non-Volatile RAM:

Random-Access Memory that is not lost when the power supply is turned off. This memory is protected by a battery.