A Guide to Electrical and Computer Engineering Biomedical Capstone Project (ECE 4BI6)

Supervisor Edition

by

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Abstract

The Guide defines the scope, content, timing and academic standards in the Electrical and Biomedical Engineering Capstone Project. Most of the essentials are contained in the first two chapters of the document. Detailed guidelines that follow provide information on the form and content of the documents required for successful completion of the design project, such as the Project Proposal, Progress Report, Abstract, and the Final Report. Although care has been taken to make the Guide reasonably accurate and helpful, it should be stressed that no document can cover all the situations encountered in engineering work. The safety associated with the project is an issue regulated by the appropriate safety regulations of the Faculty and the University, referenced in the Guide.

Keywords: Engineering design project, technical report, capstone, curriculum in electrical & biomedical engineering

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1.1 Electrical and Biomedical Engineering Capstone Design Project (4BI6): Calendar Description

The design process; safety; a two term project composed of small teams of students including an oral presentation and written report.

Three lectures, two tutorials, one capstone project; both terms
Prerequisite: Registration in Level IV Electrical and Biomedical Engineering
Antirequisite: COMP ENG 4OI4, 4OI5, ELEC ENG 4BI4, 4B15, 4OI4, 4OI5 .

1.2 Evaluation

Project components, listed in the table 1.1 on page 3, will be weighted as shown in the table and marked as described. By default, a project without a faculty (or approved external faculty advisor) will be supervised by the Project Co-ordinator.

Students must obtain at least 50 % on the Final Report ($M_{fr} \geq 20$) to pass the course.

Table 1.1: **Electrical & Biomedical Engineering Project Evaluation**

		Marking Base	Advisor (%)	Co-ordinator (%)	Judges (%)
Proposal	M_{PP}	10	50	50	
Progress Report	M_{PR}	20	70	30	
Oral Project Summary and Status (Q&A)	M_{SS}	5			100
Final Poster Session	M_{ps}	20			100
Demonstration Session	M_{demo}	5			100
Final Report & Performance	M_{fr}	40	70	30	
Course Mark	M_{4BI6}	100	47	23	30

1.3 Deadlines and Timing

All the deadlines and other important dates are listed in table 1.2 on page 4. Deadline time is meant to be the **noon** on the given date.

Table 1.2: **ECE 4BI6 Project deadlines and timing**

Issued September 11, 2009.

	Day	Date	Location
Classes start	Th	10Sep09	
Meeting of candidates with Project Co-ordinator	Fr	11Sep09 12:30-1:20pm	ITB/139
Meeting re Library resources	Th	22/23Sep09 1:30-2:20pm	T.B.A.
Meeting with Team, Advisor, Coordinator	-	prior to 30Sep09	
Project Proposal submission	We	7Oct09	CMS Submission
Progress Report Submission	Fr	27Nov09	CMS Submission
Oral Project Summary and Status (Q&A)	Mo-Fr	30Nov09-4Dec09	T.B.A
Classes end	Fr	04Dec09	
Mid-year examination period (laboratories may be closed)	Mo-Tu	7-22 Dec09	
Classes resume	Mo	04Jan10	
Conference week (laboratories may be closed)	Mo-Sa	15-20 Feb10	
Poster Presentations	Tu	6Apr10	CIBC Hall
Demonstration Session	Th-Fr	9-10Apr10	4BI6 Lab
Submission of Final Report	Fr	9Apr10	CMS & ECE 4BI6 Dropbox
Return of loans (hardware, instruments, documentation)	We	7Apr10	
Classes end	Th	8Apr10	

Some of the dates are tentative.
All submissions are to be no later than the noon of the given date.

Chapter 2

General Regulations

Students registered in Electrical and Biomedical Engineering will follow McMaster University and Faculty of Engineering Project Regulations. In addition to the University/faculty-wide regulations, the students will observe rules specific to the Department of Electrical and Computer Engineering (Biomedical Option), outlined in this document.

2.0.1 Project Description

Electrical and Biomedical Engineering Project (4BI6) is briefly described in McMaster's Academic Calendar [13]:

The design process; safety; a two term project composed of small teams of students including an oral presentation and written report.

Three lectures, two tutorials, one capstone project; both terms

Prerequisite: Registration in Level IV Electrical and Biomedical Engineering

Antirequisite: COMP ENG 4OI4, 4OI5, ELEC ENG 4BI4, 4B15, 4OI4, 4OI5.

In the Project, students are to demonstrate that they are able to enter the engineering profession, and to work independently or in a group on projects of reasonable

complexity. To facilitate the scope, content and evaluation of engineering projects and reports, Professional Engineers Ontario (PEO), the organization chartered to regulate engineering work in Ontario, proposed that the following five components must be discernible in a competently executed engineering project [1]:

- Introduction, objectives: Statement of the problem, clarification of need and requirements.
- Approach and methods: Relevant literature review. Use of suitable engineering concepts and methods.
- Analysis, synthesis, and testing: Use of modern concepts and methods for data gathering, testing, analysis and synthesis. Appropriateness of the inferences and deductions.
- Results and conclusions: Concise statement of the outcome with recommendations as appropriate. Critical evaluation of results (discussion). Evidence that the stated objectives have been met.
- Technical writing and general organization: Technical writing, English, spelling, conciseness, clarity. Cover page, index, sequence of chapters, references, appendices, overall adequacy and integration of the report.

The importance of these five components in engineering work is suggested to be approximately equal. The components are listed to point out that even though the Design Project mark weight emphasizes the final report, the report evaluation, following the PEO guidelines and customs of our school, will stress the broad range of engineering skills. The guidelines clearly state, that only approximately one fifth of the mark for the report will be based on writing and other communication skills. In other words, the Design Project is not based solely on the art of technical writing, but rather on the ability to define and solve an engineering problem.

However, the task of writing should not be underestimated. *In addition to the practical experimental and design work, in the professional life of an engineer, the manner in which oral and written communications are presented is extremely important. An engineering student must develop communication skills as an integral part of the undergraduate program. To encourage the student to do so, the grades assigned*

to all written and oral work will take into account all aspects of presentation including conciseness, organization, neatness, use of headings, and the preparation and use of tables and figures. It is also in accordance with the policy of the University, that the grade assigned to all written and oral work presented in English shall take into account syntax, diction, grammar and spelling.

2.1 Faculty Advisor

Work on the Project is done with the help of a Faculty Advisor. The Faculty Advisor is a full-time member of the Department of Electrical and Computer Engineering or an Adjunct Professor in ECE, who will guide the student in project-related matters and will grade much of the student's performance. In addition to the regular Faculty Advisor, and at his discretion, the Department may appoint an External Advisor, who would look after technical aspects of the project. If there is an External Advisor appointed, project marking will be the responsibility of the Faculty Advisor. Individuals or groups that have not obtained a Faculty Advisor will have the Project Coordinator as their Faculty Advisor.

2.2 Log Book and Gantt Chart

Each project participant will keep an up-to-date 4BI6 project log book and a project Gantt chart. The log book is a *technical diary* that must be dated and filled in regularly during the course of the project and must contain enough information to allow a person of competence comparable to that of the logbook author to execute the project. The log book and the Gantt chart will be presented for inspection to the Project Co-ordinator when a notice to do so has been posted on the the course web site. The log book and the Gantt chart will be brought to all meetings with the Faculty Advisor.

2.3 Project Meetings

Participation in the project meetings, called or posted by the Project Co-ordinator or Project Advisor, is compulsory. Penalties for meetings missed without a valid reason

are described in section 2.8.1 on page 10.

2.4 Project Proposal Submission

Project proposal submission (for deadline see chapter 1, table 1.2, page 4) will consist of the following documents:

- Project Proposal,
- Project Gantt chart.

Project Proposal will contain the following information presented succinctly and accurately:

- project description and specifications,
- project budget,
- project goals,
- methods for achieving the project goals,
- deliverables,
- expected results and performance,
- safety/ethics considerations

The submission will be marked by the 4BI6 Project Co-ordinator and by the Faculty Advisor; the mark will be calculated as indicated in chapter 1 in section 1.2 on page 2. In marking, both the Proposal and the Gantt chart will be taken into account.

2.5 Progress Report Submission

This section gives short summary of the requirements, content and form of the Progress Report; details are contained in section 5 which starts on page 23. The Progress Report submission deadline is given in table 1.2 on page 4.

Progress Report represents an important milestone in 4BI6 project work, since it is used to decide whether or not the endeavour has a chance to succeed. The student whose progress is judged unsatisfactory will be recommended to withdraw from the course.

Specifically, the student will not be recommended not to continue in 4BI6 project, if the sum of his/her Proposal mark (M_{pp}), Progress Report mark (M_{pr}), and Oral Project Summary and Status (M_{os}) less the accumulated penalties (P_{ac}) is lower than 50 %; for details *cf.* chapter 1 (section 1.2, page 2).

2.6 The ELEC ENG 4BI6 File

Each of the students enrolled in ELEC ENG 4BI6 will file and keep up-to-date the following documents with the Department (the deadlines for filing are in table 1.2 on page 4; they are also posted the course web site):

- Project Proposal,
- Project Gantt chart,
- Project Progress Report,
- Oral Presentation Abstract,
- Project Final Report.

The file is maintained by the ELEC ENG 4BI6 Project Co-ordinator, but the student is responsible for updating the filed documents whenever the project specifications, or the project execution planning details reflected in the Gantt chart, have been changed. Changes in the project must be approved by the Faculty Advisor and by the ELEC ENG 4BI6 Project Co-ordinator. Updated documents, signed by the student and the Faculty Advisor, are to be submitted via the course web site.

2.7 Group Projects

As engineers in industries often work in teams, group projects are encouraged by the Department. However, each student registered in ELEC ENG 4BI6 is required to submit his (her) own reports and other documents *i.e.* Project Proposal, Gantt chart, Log book, Progress Report, Oral Presentation Abstract, Draft Report and Final Report; no collective documents are acceptable. Any group project is subject to approval by the Department and Project Co-ordinator.

Each of the presented key documents must be prepared solely by the presenter. Any help in producing the documents or in collecting and evaluating data must be acknowledged. Proper references are also required when other peoples' design ideas or quotes from their work are used. The presenters who fail to reference the work of others could be guilty of a scholastic offence (*cf.* section 2.8).

2.8 Academic Integrity

Engineering projects require work in the laboratory, library, and reasonable writing and communication skills. As a future member of the profession, the student is responsible for performing the required work in an honest manner, without plagiarism and cheating [13]. When in doubt how to proceed without committing a scholastic offence and incurring appropriate penalty, the Advisor or the Office of Academic Integrity should be consulted.

2.8.1 Project Related Penalties

Late submission of any of the required key documents will incur a penalty of two marks per day.

Each time any re-submission is required or granted, a penalty of two marks may be imposed.

A two marks per day penalty may be imposed, if a student is late to present the project log book or Gantt chart in satisfactory form, fails to meet with the Advisor or the Co-ordinator, or fails to attend a scheduled project meeting.

Extensions of deadlines are seldom granted. If there are compelling reasons for an extension, a formal petition may be made in writing to the Project Co-ordinator.

The petition must be submitted at least three days before the deadline.

Late final reports will not be accepted, unless a recommendation for a grade of "Incomplete" (INC) has previously been approved. In the absence of such an approved recommendation, a grade "Fail" shall be assigned for the course.

Project related penalties will be accumulated throughout the year and subtracted from the final mark at the conclusion of the project.

2.9 Appeals

If an appeal becomes necessary, it will be initiated by the student. The successive levels for appeal in 4BI6 projects are:

1. Advisor,
2. 4BI6 Project Co-ordinator,
3. Department Chair,
4. Associate Dean-Academic,
5. Senate Review Board Academic.

All levels of appeal shall be by the submission of written request. Each step of the appeal procedure should be completed as soon as possible, but not later than ten calendar days from the date of the action or decision giving rise to the appeal.

Students who fail, or who must repeat any part of their project, will submit the new project to the same advisor for marking.

2.10 Final Mark

Project evaluation will follow chapter 1, section 1.2 on page 2, weighting of the components being given in table 1.1.

2.11 Return of Loans

In order to prepare the ground for success of the design project in future years, the project participants are to return at the conclusion of their work the project's hardware to their Advisors, and to return all the items borrowed from the Electronic Shop (documentation, salvageable components, instrumentation and tools). Those who would have failed to return the listed Faculty owned items by the specified date, shall receive the mark "INC".

2.12 Request for Changes

In case there are serious grounds for seeking changes in project or supervisor assignment, form Request for Changes in ELEC ENG 4BI6 Project is to be filled in. The form is available from and is to be submitted to the Project Co-ordinator.

2.13 Submission Requirements for Inclusion in McMaster Library

At the time of publishing this document, it was not confirmed that the McMaster Library would allow the final reports to be included in their collections; this appears to be primarily due to space restrictions. It may be required that the final report format specification be amended to accommodate library policies. Should it be necessary, a notice of amendment will be posted on WebCT.

Chapter 3

Project Proposal

Generally a project proposal is written to describe and justify a proposed project to the course Co-ordinator, Faculty Advisor and the Department. In the ELEC ENG 4BI6 Project Proposal, the candidate will define the content and scope of the project, present plans for its implementation, and give evidence that the project is realistic in terms of the budget and services required. The role and availability of service departments is described in sections 3.4.4 and 3.4.5). Evidence must be presented in the project proposal that the project has been discussed with the representatives of the needed services and the signatures must be included on the project proposal form of the Electronic Shop Supervisor, the Machining Services Co-ordinator and the Chair of the Computer Users Committee.

Individuals or groups are required to fund their own projects. If funds are to be provided from other sources, *e.g.* the faculty or an external advisor research funds, the source of the funds should be stated and the confirmation of acceptance of the cost included.

In the past, projects proposed by the students and industries have been supported. This policy will likely be continued, but it should be recognized that the final approval of any project is subject to the consent of the Department and Project Co-ordinator. It should be noted that the Department may only approve projects that meet the requirements of the Canadian Accreditation Board. It is required that at least a half of each project can be classified as synthesis. This requirement has impact on the 4BI6 project's approval policy: projects which are of a purely investigative nature are not acceptable. The project safety is also a growing concern, and no project shall

receive the final approval until its safety aspects are known and clearly described in the project proposal. Project safety is discussed in chapter 11 on page 51 and the names of safety officers are listed in chapter ?? on page ??.

3.1 Group Projects

A group project may be acceptable, if it consists of well defined modules, and if the responsibilities of each of the group participants are clearly defined. In a group project, each student will submit an individual report, listing the other group members and indicating the report author's area of responsibility within the project. Collective submissions are not allowed.

3.2 Faculty Advisor Approval

Faculty Advisor must be consulted before the project proposal is submitted. Project topic is to be discussed with the Advisor and his/her signature obtained.

3.3 Proposal Submission and Marking

The following documents shall be submitted at the location and by the deadline specified in chapter 1 in table 1.2 on page 4:

- Project Proposal text,
- Project Gantt chart.

Project Proposal shall be submitted typewritten, using the format shown in appendix A.1 (page 54). The Gantt chart shall follow the convention given in chapter 4 (*cf.* page 20).

The report grades will be collected by the students from WebCT after their availability has been posted. The mark and weight assigned to the report is specified in chapter 1 (table 1.1, page 3). The students whose report is judged unsatisfactory or incomplete may be given the opportunity, or may be required, to re-submit the entire report or its parts. The re-submission shall not be re-marked, but the failure

in meeting the re-submission deadline is subject to penalties specified in chapter 2, section **??** on page **??**, and in section 2.8.1 on page 10.

3.4 Proposal Content and Form

The proposal submission should follow the following general guidelines regarding the content and form:

- *Project Summary* should contain approximately 500 typewritten words.
- *Progress to Date* should not be longer that 500 words.
- References must conform to the IEEE standard used in engineering journals (*cf.* section 9.5.16, page 42).
- The report format shall follow the format template[1] shown in appendix A.1 on page 54), that comprises:
  - Project Summary (definition, background, methodology),
  - Progress to Date (literature search, theory, design),
  - Statement on Safety,
  - Services Required (Project cost),
  - Approval of Services Required.
- Project Gantt chart.

3.4.1 Project Summary

The *Project Summary* is a short version of the preliminary report on the proposed project. It consists of three parts: *Definition*, *Background* and *Methodology*.

Definition

Project definition states briefly and clearly the objectives of the project, and specifies what is to be delivered at the conclusion of the project.

[1] Additional pages may be attached if justified.

Background

This section provides the introduction and background to the project. It describes the context of the work, particularly the major ideas on which the project is based. The reason for the project is given and it is discussed why the project is important or significant. It is stated what is the contribution of the project to the field of engineering. References are provided to the previous work known to be done in the project area. Sufficiently detailed discussion is required to prove that enough background reading and preliminary study has been done to justify design decisions. Literature review points out

- aspects which have not been considered before and therefore make the project original,
- limitations and shortcomings of similar previous projects,
- aspects which have been indicated in literature as being in need of further work.

The section *Background* also outlines questions and assumption needed in the course of the project work.

Methodology

This part of the proposal outlines the methods which will be used in order to achieve the goals of the project. It should describe in as much detail as possible the procedures used in the project, whether they be related to design, measurement, data acquisition, *etc.* Reference should be made to the methods described in literature to justify the selection of methods that are to be used in the project. The reliability of the methods is to be shown and proof is to be presented that the objective of the project can be achieved. In summary, *Methodology* is a succinct presentation of the proposed plans for completing the project.

Time Line

Project time line specifies the time required for achieving the project goals. In order to define the time line, the project must be divided into task modules, and the interdependence of the modules considered. In engineering projects, it is customary

to present time line in the form of a graph, called a Gantt chart, which may be complemented graphically or textually in the project proposal. As the time line is important in engineering projects, it is described in a separate chapter (chapter 4 on page 20).

3.4.2 Report on Progress to Date

The report should briefly describe what has been accomplished, with clear estimates of the degree of completion. The report is to be divided into logical topics, *e.g.* literature search, theoretical development, equipment design, *etc.* and to indicate the degree of progress *e.g.* literature search completed, equipment design 90 % complete, *etc.*

3.4.3 Project Safety

This section shall contain a description of the safety measures that are to be taken to ensure a risk-free execution of the project work. More detailed discussion of the safety problems in engineering projects is contained in chapter 11 on page 51. For questions regarding safety measures, the student is referred to the office of Environmental and Occupational Health and Safety Support (www.workingatmcmaster.ca/eohss/).

3.4.4 Project Support Services

Projects may require support of service departments of the University (*cf.* chapter **??**, page **??**). Most often, support is needed from the Electronic Shop, the Machining Services, or a block of time is needed on a special computer or a workstation, operated by the Faculty or by the University Technology Services of the University. The proposal shall be discussed with the providers of these services, and their approval of the project requirements indicated by signatures of the supervisors (Electrical Shop Supervisor, Machining Services Shop Co-ordinator and Chair of Computer Users Committee).

For shop estimates, professional-level drawings, diagrams and material lists must be prepared and attached to the proposal text. The proposal, approved by the Advisor, shall be submitted to the appropriate service supervisor for a written estimate of costs. The assistance available from the workshops is limited. It should be noted that

neither the Electronic Shop nor the Machining Services can provide instant estimates, or estimates based on substandard drawings. Specifically, the Electronic Shop shall not provide budget estimates for projects, that have not been previously approved and initialed by the Project Advisor. The deadline for request for budget estimates is specified in chapter 1 and posted at various information media.

The Project Co-ordinator and Advisor shall review the report and may provide their comments. If either of the reviewers is of the opinion that the report is unsatisfactory, the student may be given a new deadline to re-submit the report. It is essential that the project approval be obtained on schedule, so that work can be completed within the given time. The services mostly operate on a first-come first-serve basis.

3.4.5 Laboratory Technicians

The amount of assistance available from laboratory technicians is limited. Request for assistance above the level described in chapter **??** (page **??**) must be approved by the Faculty Advisor.

3.4.6 Project Cost

The project is to be funded by the candidate with an expected cost equivalent to an engineering course textbook. If funds for the project are to be drawn from research funds or funds external to the Faculty, evidence must be provided of the agreement that the funding has been secured.

3.5 Project Proposal Check List

The check list may be helpful in order to make sure the Project Proposal submission is complete. The submission minimum content can be listed as:

1. Project Summary (500 words, typewritten, contains objectives, background and scope);
2. Project Progress to Date (500 words, typewritten);
3. References;

4. Project Gantt chart;
5. Design drawings, schematics and parts lists;
6. Approval of the Faculty Advisor;
7. Estimate of the support required from the Electronic Shop and funds needed for the purchase of parts, signature of the Shop Supervisor;
8. Estimate of time required from Machining Services, signature of the Shop Co-ordinator;
9. Estimate of the time required on special computer facilities.

Chapter 4

Sample Gantt Chart

Gantt chart is a tabular chart for project time management. It expresses the time line of the project (*cf.* section 3.4.1 on page 16). The chart lists project task modules and the associated time modules, and shows dependencies of the modules. During the tenure of the project, the Gantt chart is updated to reflect the changes in the project that might bear on its time line.

Gantt chart is organized as a time – task array:

$$
\begin{array}{rcl}
\{ & & \\
project & \hookrightarrow & time \\
module1 & \hookrightarrow & \triangle\ time1\ \triangledown \\
module2 & \hookrightarrow & \triangle\ time2\ \triangledown \\
\ldots & & \\
moduleN & \hookrightarrow & \triangle\ timeN\ \triangledown \\
\} & &
\end{array}
$$

In order to construct the Gantt chart, the project must be divided into task modules (literature search, analysis, design, programming, assembly, integration, iteration, *etc.*), and the time available for the project divided into time blocks that follow the sequence required to finish the task on time. The Gantt chart table is marked with bars that show the time required to complete each task. The beginning of a time bar is often marked with an up-pointing triangle ($\triangle$), the end with a down-

pointing triangle ($\bigtriangledown$), and the milestones with a diamond ($\diamond$); dates are sometimes included next to the marks. A simple sample Gantt chart is shown in figure 4.1 on page 22.

A number of software packages are available for constructing Gantt charts (Visio, Project, Excel *etc.*). However, most commercial programs are designed assuming that complex tasks, requiring co-ordination of many people be handled, and so often proportionally higher effort has to be invested to master the details of the program that produces the chart. Since the 4BI6 Project is limited in time and complexity, a simple hand-made chart is adequate for its management.

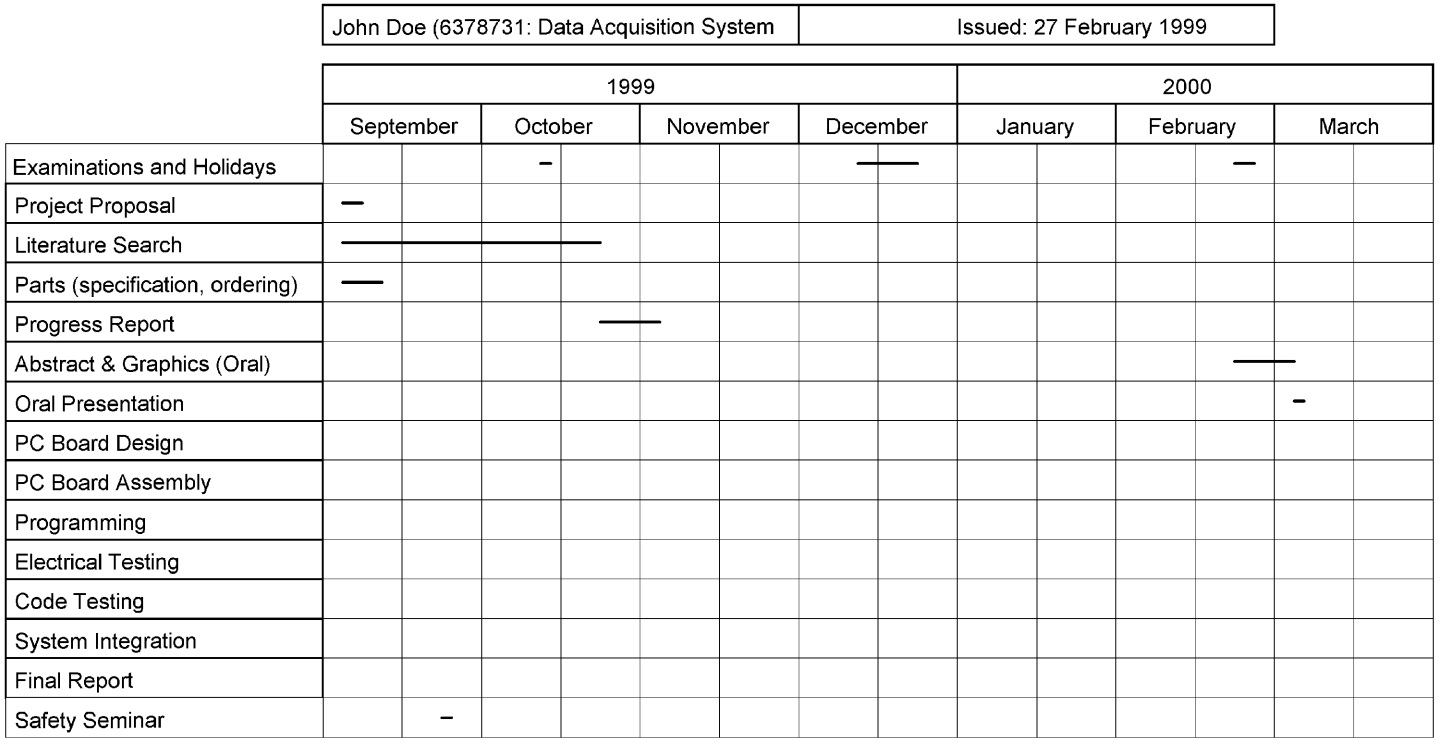

Figure 4.1: A sample Gantt chart.

Chapter 5

Progress Report

Progress Report is a succinct description of the work accomplished to date, with estimates of the degree of completion (see also section A.2, page 59). The report is to be divided into logical sections, *e.g.* literature search, theoretical development, equipment design, *etc.*, and to indicate the degree of progress *e.g.* literature search completed, equipment design 80 % complete, *etc.* An updated Gantt chart is to be submitted with the report.

The report also describes problems and concerns, especially those so far unresolved. Outstanding problems may be divided into two categories, namely

- objective: related to equipment, space, technical support, *etc.*, and
- subjective: related to other difficulties such as writing, theoretical developments, interpretation of results, *etc.*

In a group project, all group members are to be listed and their area of responsibility indicated.

This report is to be submitted via WebCT, typewritten, double spaced, with no more than four pages in length in addition to the required updated Gantt chart. It is to follow the format shown in section A.2 on page 59. The report submission deadline is specified in chapter 1 in table 1.2 on page 4. The report is to be handed in to the Department Office and handled and marked in the same manner as the Project Proposal. The combined mark for the Project Proposal and Progress Report is specified in chapter 1 in table 1.1 on page 2.

The Faculty Advisor and Project Co-ordinator shall review the Report and may add their comments. If any of the two reviewers finds the report and the volume of work on the project unsatisfactory, the candidate will be asked to withdraw from the course. If only the report is classified unsatisfactory, the author may be given a deadline to submit a revised report. The re-submission shall not be re-marked, but the failure to meet the re-submission deadline is subject to penalty.

The reports grades and comments will be available on WebCT when posted.

Penalties for late, or inappropriate submission (or re-submission) are specified in chapter 2 in section 2.8.1 on page 10. All penalties will be subtracted from the final mark at the conclusion of the course.

5.1 Progress Report Checklist

The following documents are to be included in the Progress Report submission:

1. Progress report text (typewritten, double spaced, no more than four pages, following report template shown in appendix A.2 on page 59), containing:
   (a) A short title for oral presentation,
   (b) Progress Report containing sections:
      i. a statement of progress to date,
      ii. goals,
      iii. outstanding problems.
2. Updated Gantt chart.

Chapter 6

Oral Project Summary and Status (Q&A)

The Oral Project Summary and Status (Q&A) is a course question and answer period to present a brief background and update of the project status. The format will be informal with audio-visual equipment available for the presentation.

The mark assigned to the oral project summary and status presentation is weighted as listed in section 1 in table 1.1 on page 3. Presenters will be judged by members of the course. Course member presence and participation in the judging is a mandatory course component. Failure to be present and participate in all presentations will reduce this component grade for the student failing to meet this requirement. All students registered in 4BI6 must present their summary and status at their specified time during the period scheduled for the presentations.

6.1 Audio-visual Equipment

Presentation is limited to a 10-minute talk followed with a 5-minute question and answer period. The use of graphical material is encouraged; facilities for view-graphs, slides, and data projectors will be provided. Each author is responsible for ensuring that the presentation material be compatible with the facilities.

Chapter 7

Final Oral Presentation

The Final Oral Presentation is a public seminar, which gives opportunity to the engineering candidate to present his (her) project to a panel of judges, to his (her) peers and to the general public.

Oral presentations are a 4BI6 course event where the Department, University Community, and General Public will be invited. Exact timing and location of the Oral Presentations is determined jointly by the Project Co-ordinator and Department. Although the date of oral presentations is listed in section 1 in table 1.2 on page 4, the co-ordination of oral presentations requires much work and inevitably some last minute changes. WebCT should be consulted for possible changes in the time, location and scheduling of the presentations.

The mark assigned to the oral presentation is weighted as listed in section 1 in table 1.1 on page 3. Presenters will be evaluated by at least two judges which may be from the University or industry . All students registered in 4BI6 must present their projects at their specified time during the period scheduled for the presentations.

7.1 Oral Presentation Abstract and Keywords

Oral Presentation Abstract will highlight briefly the candidate's project.

The following information should be included in the Abstract:

1. the purpose of the project,
2. the scope of the project,

3. project methods,
4. results,
5. conclusions,
6. recommendations,
7. keywords.

The information should be brief and supported quantitatively. The abstract should be no longer than 250 words, centered on the page and single-spaced, without a cover sheet. An abstract is formatted as a single paragraph, with no headings nor subheadings. For a sample abstract and keywords *cf.* appendix A.3 on page 62.

The abstract's submission deadline is specified in chapter 1 in table 1.2 on page 4. Copies of the abstract will be made available to all of the examiners prior to the Oral Presentation. The abstract will not be returned to the author after the Oral Presentation. It will be marked by the Chair of the student's Oral Presentation examination committee, and may be marked also by one or more of the judges; marks will be averaged. The mark for the Abstract contributes to the 4BI6 mark as specified in section 1 in table 1.1 on page 3.

7.2 Audio-visual Equipment

Presentation is limited to a 15-minute talk followed with a 5-minute question and answer period. The use of graphical material is encouraged; facilities for view-graphs, slides, and electronic projectors will be provided. Each author is responsible for ensuring that the presentation material be compatible with the facilities.

7.3 Dress Code

It is suggested that in oral presentations, the IEEE conference dress code [2] be observed. Men presenters are required to wear coat and tie with dress trousers, women business attire.

An article published in London Free Press[1] recommended that students observe dress code at formal and semi-formal occasions. It was suggested that male students dress in a dark jacket, dark trousers, white shirt, conservative tie and black leather shoes. Female students were recommended to wear dark skirt, white blouse and black shoes. The article warned against wearing running shoes and blue jeans. The newspaper claimed that those who follow dress code have more success in job interviews and similar events.

7.4 Additional Information

For judging oral presentations, most judges use criteria similar to those given in section 2 on page 5. Problems encountered in short oral presentations are described in appendix A.5 on page 64.

7.5 Student Technical Night

This section is currently under development.

Students who wish to enter their projects in extramural competitions will find a partial list of such events in appendix A.6 on page 66.

[1] April, 1995

Chapter 8

Final Poster Presentation

The Final Poster Presentation is a public session, which gives opportunity to the engineering candidate to present his (her) project to a panel of judges, to his (her) peers and to the general public. While less formal than a seminar, the poster session allows judges to quickly assess the technical merit the project and knowledge of candidate(s). A poster is a group presentation and thus requires careful organization of the poster space to demonstrate each member's work.

The Poster session is a 4BI6 course event where the Department, University Community, Industry, and General Public will be invited. Posters must be set up at the beginning of the session and judges will make their rounds examining the projects. Group members must be present when the judging panel comes to their station – judges will not return. Approximate timing of the judging shall be provided and determined jointly by the Project Co-ordinator and Department.

The mark assigned to the poster presentation is weighted as listed in section 1 in table 1.1 on page 3. Presenters will be evaluated by at least two judges which may be from the University or industry . All students registered in 4BI6 must be present when their project poster is judged.

8.1 Audio-visual Equipment

The poster session cannot provide audio-visual equipment for all groups simultaneously. In addition, it cannot be guaranteed that each station will be able to access power. This has ramifications in demonstration your work. If your device is batter

operated then you are advised to have fresh set ready for the judges (there may be more than one group of judges). If your device cannot be demonstrated outside of the lab, you are advised to have printed images or a short video that may be displayed via your laptop computer.

8.2 Dress Code

The IEEE conference dress code [2] should be be observed for all public presentations. Men presenters are required to wear coat and tie with dress trousers, women business attire.

An article published in London Free Press[1] recommended that students observe dress code at formal and semi-formal occasions. It was suggested that male students dress in a dark jacket, dark trousers, white shirt, conservative tie and black leather shoes. Female students were recommended to wear dark skirt, white blouse and black shoes. The article warned against wearing running shoes and blue jeans. The newspaper claimed that those who follow dress code have more success in job interviews and similar events.

8.3 Additional Information

For judging poster presentations, most judges use criteria similar to those given in section 2 on page 5.

8.4 Tips for Making Posters

`http://www.ncsu.edu/project/posters/NewSite/` `http://www.swarthmore.edu/NatSci/cpurrin1/posteradvice.htm`

[1] April, 1995

Chapter 9

Final Report

9.1 Final Report Submission

Final Report is the summary of the entire work performed on the 4BI6 project. The report is important in assessing the results of the project, and care should be taken to document and summarize in it all the project achievements. The deadline by which the Final Report is to be submitted to the ECE Office Dropbox is given in table 1.2 on page 4. It is recommended that the Final Report be limited to a maximum of sixty pages, including appendices.

Two copies of the Report are required: an original in hardcopy and a duplicate in softcopy. These two copies are to be presented as described in the following paragraphs.

Computer programs on disk or CD-ROM may be enclosed to each of the reports.

9.2 Report Format

The task of preparing the Final Report should not be underestimated. The reasonable length of the final report is sixty pages, including appendices. The report is to follow the style manuals listed in the Bibliography section of the Guide. The manuals also describe many of the problems encountered in the preparation of a manuscript ([11], [14], [15]).

9.2.1 General Rules for Report Format

In electrical (including computer and biomedical) engineering, professional presentations follow the conventions defined by the Institute of Electrical and Electronics Engineers, which publishes a number of technical and scientific journals. The journals can be consulted for the details of the report presentation, namely the form of headings, citations and the presentation of figures tables and mathematical expressions. Some of these journals are available in the Thode Library:

- *IEEE Transactions on Antennas and Propagation*,
- *IEEE Transaction on Automatic Control*,
- *IEEE Transaction on Biomedical Engineering*,
- *IEEE Transactions on Communications*,
- *IEEE Transactions on Computers*,
- *IEEE Transactions on Industry Applications*,
- *IEEE Transactions on Neural and Rehabilitation Engineering*, *etc.*

Presentations in these journals follow conventions defined by the Institute; however, presentation of reports is slightly different than that of papers. This particular Guide can be used as an example of a professional report presentation and as a template for the 4BI6 Final Report[1]. Further information on report formats is available from the Faculty for Graduate Studies of the University, which is responsible for defining the presentation of graduate theses.

As many programs are available for report writing, many industries and departments at institutions require that a specific program be used for report submissions. It is the candidate's choice which program to use for creating the final report. Common programs such as OpenOffice, Adobe PageMaker, or Microsoft Word give acceptable results.

This Guide is set in LaTeX 2_ε, which is used for producing engineering reports in industrial environments, and in book-printing. Professional typesetting programs

[1]Note that this report's line spacing is one; a 4BI6 report is to have line spacing 1.5.

such as LaTeX define a number of standard document classes, among them *class article, report, letter*, that yield generally accepted layouts. All publishers and professional societies accept files generated by these programs for electronic submission of manuscripts. Those who would like to become familiar with professional typesetting tools may use LaTeX or TeX style files available from the IEEE Societies web sites, namely the template IEEEtran.cls, described by Murry and Balemi [12]. A more complete treatment of document typesetting problems can be found in a book by Kopka *et al.* [6] and in foundation works on computer typesetting by Knuth [5] and Lamport [9]. A good introductory book on LaTeXtypesetting is *First Steps in LaTeX* by George Grätzer [3].

9.2.2 Criteria for Acceptability of Report

The criteria for acceptance of the report are listed in detail in this guide. In general it is required that:

- the text and accompanying illustrative material be clear and error free,
- the layout of each page be set within standard margins,
- sufficient quality paper be used.

9.3 Report Presentation

9.3.1 Paper

The original typescript must be produced on 21.5 × 28 cm (8.5 × 11 inch) paper and printed or photocopied (resolution at least 300 d.p.i.) on a good quality paper, such as 20 lb Xerox paper.

9.3.2 Typescript

Printing or typing must be on one side of the paper only, using 12-point Computer Modern of Times New Modern font, with line spacing 1.5[2] for all textual material

[2]Line spacing in this Guide is set to 1.0.

(body of the report and appendices); footnotes and long quotations are single-spaced and use 10-point font size. The size of a font is given by the vertical dimension of the square bracket ([), measured in points; one point is 1/72 inch.

The entire report must be in the same black typescript, and care should be taken to ensure evenness and blackness of fonts; no colour text is allowed. If necessary, tables may be typed and then reduced to 8.5×11 inch size. As already mentioned, for the best copy, reports should be printed on a laser printer or duplicated by xerography with resolution of at least 300 dot-per-inch. If there is a doubt about any aspect of the typescript, a few sample pages should be submitted to the Project Co-ordinator for approval.

9.3.3 Spelling

In the report, Canadian or British spelling is to be used, as found in:

- Dictionary of Canadian English,
- Oxford English Dictionary.

American spelling is not acceptable.

9.3.4 Units

The International System of Units (S.I.) shall be used unless there is good reason not to do so. Units may not be mixed. Permission to use other than S.I. units must be obtained from the Faculty Advisor. Copies of The International System of Units (S.I.), CSA, CAN3-Z234.I-79 and *cf. AIP Style Manual* citeAIP:1990 are available in the Library. A list of S.I. units is also available from the web site of the Institute of Physics (IOP)[3] or the American Institute of Physics (AIP)[4].

9.3.5 Margins

The specified margins must be observed on all copy, since it is expected that the reports are to be bound and placed in the library. A 38-mm (1.5 inch) margin

[3] www.iop.org
[4] http://ojps.aip.org/aplo/aplsubmit.jsp

from the left-hand edge of the paper is required to allow for binding. Twenty-five millimetre (1 inch) margins are used from the top, bottom and right edges. These margins also apply to all illustrative material: diagrams, maps, photographs, charts, tables, computer print-outs, *etc.*

9.3.6 Corrections

Corrections should be avoided if possible. Correction fluid used neatly and sparingly is permissible, but pages with numerous corrections are not acceptable.

9.3.7 Footnotes

On occasion it is useful to use a footnote[5] in addition to references. Such a note must be identified at the appropriate place in the text with a super-script Arabic numeral and included with the same number at the bottom of the page. Footnote form should follow the style guides, available in the Library, or the style conventions used in papers, published in IEEE Journals and Transactions.

9.4 Auxiliary Material

9.4.1 Illustrative Material

All illustrative material must be reproduced on 8.5×11-inch 20-lb bond paper. Each figure, table, *etc.* must be numbered and captioned. Either Roman or Arabic numerals may be used for tables and figures but Arabic numerals are to be used if the number of figures (or tables) exceeds twenty.

- Figure number and caption must appear beneath the figure (*cf.* figure A.4 on page 63).
- All terms, abbreviations, and symbols used in illustrations must correspond to those used in the text.
- Table numbers and caption must appear above the table (*cf. e.g.* table 1.1 on page 3).

[5]Footnotes are to be used sparingly.

- All illustrative material must be listed in the preliminary part (*cf. e.g.* sections on page 1).

- All tabular material must be listed in the preliminary part (*cf. e.g.* sections on page viii).

9.4.2 Diagrams, Maps, Graphs and Tables

Diagrams, maps and graphs may either be produced on a good quality laser printer or drawn in black ink. If the report includes illustrations, which have been reproduced from a book or paper, the reproduction must be taken from the original, not from a photocopy. Such illustrations must be properly referenced and the copyright law must not be infringed by the inclusion. If colours are used in the original's graphics, all submitted copies of the report must have colour graphics.

9.4.3 Photographs

Photocopies of photographs are acceptable, provided that there is no appreciable loss of contrast or definition. In cases where actual photographs are mounted on the pages of the report, dry mounting tissue should be used. Stick and spray adhesives are also acceptable, but rubber cement, liquid glue, staples and adhesive tape are not.

9.4.4 Computer Print-Outs

Computer print-outs including plots must be dark enough to reproduce well and must have the standard margins. Pages larger than 8.5×11 inches must be photo-reduced but the material must still be readable. The text contained in the plots should be of the same font family as that in the report; ± 50 % deviations are acceptable. If the printout of graphs is done by a third party, it is sometimes possible to specify that the print-out is for reproduction. It is not reasonable to include listing of excessively long programs, it is better to include them on CD-ROM or disk.

9.4.5 Reductions

Professional facilities for reducing illustrative material are now commonly available. To provide clear reductions the following suggestions for masters are offered:

- lines after reduction must be approximately as thick as letter "l" in text,
- spaces between lines must be wide enough not to merge together in reduction, and
- all lettering should be open style so that it will not block on reduction, and must be large enough to be legible after reduction (size after reduction should not be smaller than half size of the font used in the body of the report).

9.4.6 Over-Size Pages

If charts, graphs, maps and tables larger than the standard page size have to be used in your report, they should be folded into the manuscript. The fold should extend to about 1/8 inch of the full width of the page.

9.5 Report Structure

9.5.1 Titling the Report

It is essential that the title be a meaningful description of the content of the work. Oblique references are to be avoided, and word substitutes used for formulae, symbols, superscripts, subscripts, Greek letters, *etc.* When a report title is lengthy, a short title of approximately forty characters (including spaces) is needed for the oral presentations. A sample title page has been included in section 9.6 on page 44.

9.5.2 Final Report Abstract

The final report abstract is expected to give a succinct account of the report so that one can readily decide if the entire work must be read. Although headings are not used, an abstract contains:

- statement of the problem,

- procedure or methods,
- results,
- conclusions.

Abstract is not structured in paragraphs, and there are no references cited in it. The abstract for final report is similar to the abstract used for oral presentation (*cf.* appendix A.3, page 62).

9.5.3 Final Report Keywords

Keywords are included at the end of the abstract. The keywords are used when assigning subject headings and index terms in libraries. The same or similar keywords may be used as those in the Oral Presentation. Examples can be found in the Guide's abstract on page iii and in the oral presentation sample abstract on page 62.

9.5.4 Numbering Pages

Each page in a report must be assigned a number for cross-referencing. Page numbers of the same size and font are also required on the all items of illustrative material. The cover (*cf.* section 9.6.1, page 44) is not numbered, but the title page is, although the numeral is implied. The title page starts the preliminary section.

9.5.5 Preliminary Part

The accepted order within the preliminary part of the report is the same as in this Guide:

- Title Page (*cf.* 9.6.2, page 45),
- Abstract (*cf.* 9.6.3, page 46),
- Acknowledgments (*cf.* 9.5.19, page 43),
- Table of Contents (*cf.* 9.6.3, page 46),
- List of Tables (*cf.* 9.6.4, page 47),

- List of Figures (*cf.* 9.6.4, page 47),
- Nomenclature (*cf.* 9.6.4 and **??**, page 47 and **??**).

For the preliminary part small Roman numerals are used for page numbers. The numbering begins with the Abstract as "ii" (the Title Page counts as page "i", but the number does not appear). The numerals are placed in the centre of the page, 0.5-inch from the bottom.

9.5.6 Body of the Report

For the remainder of the report – including the text, illustrations, appendices, references, and vitae – Arabic numerals are used to number pages, beginning with "1" and running consecutively to the end of the report. The numerals are placed in the upper right hand corner about 0.5 inch from each edge. On pages carrying a major heading such as the first page of a chapter or the references – the page number should be at the centre bottom of the page.

9.5.7 Use of Headings

It is usually easier to read a report if headings and sub-headings are used judiciously. When using headings, a generally accepted order of priority must be used. The font size and labelling style used in this report is most common in professional reports. The heading styles used in papers published by the Institute follow:

- Small Caps Typestyle, used for section headings in IEEE papers,
- *Italics*, used for subsection headings in IEEE papers,
- **bold face** used for emphasis.

All of the above examples are in Times Roman font family, favoured in professional presentations. For further details and recommendations, a style manual should be consulted.

9.5.8 Suggested Chapter Headings

The following suggestions are for guidance and will be suitable for the majority of reports. However, in a particular report some variation may be appropriate, if approved by the Faculty Advisor.

9.5.9 Introduction

The introduction should provide the background for the project and clearly state the objectives, the methodology, and the scope.

9.5.10 Literature Review

Literature review should list the relevant work in the field of study. It should be comparative in nature and critical where appropriate. Web sites, application notes and reference manuals are not suitable as references and may be used as footnotes.

9.5.11 Statement of Problem and Methodology of Solution

Theoretical developments that are new, or are essential to the understanding of the main body of the report, should be presented. One must exercise judgment about the amount of detail to be presented here. In instances where the theory is not the main thrust of the report, it is often appropriate to present a skeletal outline of theory emphasizing the important features, with references to a detailed account in an appendix.

9.5.12 Experimental or Design Procedures

Descriptions of apparatus and procedures (both experimental and design) may appear in one chapter, but this is not a general rule: It may be more appropriate for a particular report to separate these topics into two chapters. The level of detail should be such that another person with comparable knowledge and experience should be able to duplicate the procedures from the descriptions given. This requires a clear, concise description of the procedures and a detailed description of special apparatus that has been designed and fabricated. It may be appropriate to relegate part of the details of such designs to an appendix.

9.5.13 Results and Discussion

Results and discussion may be presented together in one chapter or separately in two chapters depending on the nature of the project. The results of experiments or tests should be in graphical or tabular form. The form chosen depends on the nature of the results. In some instances it may be necessary to support a graphical display with tabulated data in an appendix. Graphs and tables should be prepared carefully, making sure that the units of quantities are specified. Each table or graph must include a clear description of the results and their meaning. The discussion is very important and should be a thoughtful interpretation of the results as they relate to the objective of the project.

9.5.14 Conclusions and Recommendations

This section should be concise and should emphasize the significant conclusions reached. Conclusions must be based on the evidence presented and must be related to the stated objective of the project. No new ideas are proposed in this section. The recommendations for future work must be carefully stated and should follow logically from the discussion and conclusions of the work done for the project.

9.5.15 Appendices

It is usually desirable to keep the main body of the report as concise as possible, and to use appendices for the completeness of the report. However, the main body should be sufficiently complete that the reader can understand the report without reference to the appendix. Examples of information that might be relegated to appendices are:

- design details and detailed theoretical developments that are not the main thrust of the project,
- tabulated data used for drawing graphs in the main body,
- list of instrumentation, specifications, calibrations, *etc.*, and
- listing of computer programs used.

9.5.16 References

Include the list of references immediately following the appendices. There are two accepted ways to cite references in text: the Harvard and the Vancouver type citations. Most IEEE Journals accept any one of the two methods, but the final decision rests with the editorial board.

The Harvard citations use author's name and year of publication in square brackets, *e.g.* [Wintle, 1987]. The Vancouver method requires that each reference in the Bibliography section be numbered by an Arabic numeral; the numeral is then cited in the text, *e.g.* the reference to the previously mentioned Wintle's paper would be cited as [16]. Author may refer to an IEEE journal appropriate to the appropriate discipline and adopt the method used in that journal. Most IEEE journals (and this Guide) use the Vancouver method, *i.e.*:

- Reference in the text is done by citing the number of the reference in brackets, immediately following the comment related to the reference, *eg.* "In determining the field distribution, the method described by Wintle [16] was used, and the analysis presented by Jones [4] was applied to the trajectories of particles."

- The references in the Bibliography section are listed alphabetically or in the order in which they appear in the text.

The two references, one to a periodical ([16]) and the other to a book ([4]) appear in the following form in the Bibligraphy:

[4] Thomas B. Jones, *Electromechanics of Particles*, Cambridge University Press, 1995.

...

[16] H.J. Wintle, "Space charge limited current in the needle-plane geometry," *J. Electrostat.*, 1987, vol.19, pp.257-274.

The alternate Harvard method includes references in the following two forms: "The spectrum was measured by Kucerovsky *et al.* (1985) and the oscillations by (Louisell 1960)." The Harvard-style sources are listed in the Bibliography without Arabic numbers, always in alphabetical order:

Kucerovsky, Z. (1985), I.I. Inculet and A.K.W. Lee, "Spectroscopic analysis of a corona space charge in a cylindrical system with air-carbon dioxide medium," *IEEE Trans. Ind. Applicat.*, 1985, vol.IA-21, pp.17-22.

...

Louisell, William H. (1960), *Coupled Mode and Parametric Electronics*, John Wiley & Sons, New York and London.

As stated earlier, the article by Kucerovsky and the book by Louisell can be referenced numerically, using the Vancouver convention, as [7][10] (the numbers in square brackets correspond to entries in Bibliography section of the *Guide*).

9.5.17 Direct Quotes and Copies

When it is found useful to quote directly from other sources, the reference must be clearly stated, and the material quoted enclosed in quotation marks or italicized. In some cases you may wish to reproduce figures from other sources; in such cases credit must be given to the source and one must be aware of possible violation of copyright regulations and plagiarism.

9.5.18 Vitae

A vitae page must be included. See sample Vitae in section 9.6.5 on page 48.

9.5.19 Acknowledgments

Acknowledgments must be written in the third person and be kept to a concise recognition of relevant contributions.

9.6 Samples of Key Pages

9.6.1 Cover Template

Design of Remote Sensing Instrumentation for the Study of Optical and Thermal Energy

by

Jane Doe

Electrical and Biomedical Engineering Design Project (4BI6)
Department of Electrical and Computer Engineering
McMaster University
Hamilton, Ontario, Canada

9.6.2 Title Page

Design of Remote Sensing Instrumentation for the Study of Optical and Thermal Energy

by

Jane Doe

Electrical and Biomedical Engineering
Faculty Advisor: Prof. Smith

Electrical and Biomedical Engineering Project Report
submitted in partial fulfillment of the degree of
Bachelor of Engineering

McMaster University
Hamilton, Ontario, Canada
March X, 200X

9.6.3 Sample Table of Contents

Contents

9.6.4 Sample Table of Figures

List of Figures

The List of Tables is similar in appearance. Pages used for both of these lists are numbered in Roman numerals at the bottom of the pages, as shown:

9.6.5 Sample Vita Page

VITA

NAME:	Jane Doe
PLACE OF BIRTH:	London, Ontario
YEAR OF BIRTH:	1982
SECONDARY EDUCATION:	Centennial High School (1993-1997)
HONOURS and AWARDS:	Ontario Scholar 1995, 1996, 1997
	PEO Entrance Scholarship
	Dean's Honour List 1999, 2000
	etc.

Chapter 10

Legal Aspects

Work on engineering projects is regulated by laws that originated at various levels of Government, and by regulations and customs of the University and various professional organizations. Of special interest are the laws and regulations related to work safety, which are discussed in a separate chapter (*cf.* chapter 11, page 51).

A number of projects are undertaken solely to meet the requirements of the course. However, several projects have produced new knowledge or marketable objects, based on original ideas of either the Faculty Advisor or the student. The laws and customs related to the ownership of intellectual property and its commercialization should be taken into account, and a written agreement made concerning the ownership of the proceeds of the project.

A number of times, design projects were undertaken, supported or initiated by industries. Often, the industrial sponsor assumes or requires that the results of the project be kept confidential, and access to the results be limited to a limited number of people. It should be noted that although the Department of Electrical and Computer Engineering supports industrial projects, it cannot guarantee the level of confidentiality comparable to that common in industrial environment. The student cannot be excused from presenting the required project documents (project proposal, progress report, oral presentation abstract and final report). By definition, these reports will be available to the academic staff of the Department. In addition to the Department, project content will be disclosed to a panel of judges in the oral presentation, open to general public. Most concerns regarding confidentiality are usually associated with the disclosure of the final report's content and with the control of

the access to it. For grading, the final report will be read by the Faculty Advisor and Project Co-ordinator but, if the industrial sponsor wishes, it will not be made available to the general public.

Copyright laws should be consulted before material from books and papers would be included in the final report. It should be noted that a proper acknowledgment and referencing only avoids the problem of plagiarism, but not that of the copyright violation.

Work on engineering projects often requires field work, visit of industrial/clinical sites, or it may require that an external person visit University facilities. Before any of these events take place, a candidate must consult with the Project Co-ordinator.

Chapter 11

Work Safety

Laboratory work involves a measure of personal risk. Caution should be used when working with high voltage power supplies, sources of radiation, compressed gases and various machines. A person that feels uncomfortable using unfamiliar equipment should seek help and should not try to solve problems by trial and error. It should be noted that no project shall be approved until it is specified to the degree that would allow to determine and alleviate the potential risks associated with the project's execution (*cf.* section 3.4.3 on page 17). A brief version of the Ontario regulations regarding the occupational health and safety is contained in reference [8].

All new equipment at the University must be approved by either the Canadian Standards Association or Ontario Hydro, Electrical Inspection Department. It is allowed to construct an electrical system for research or instruction on the University premises, but the system must be comprised of components that comply with the Electrical Equipment Policy of the University.

Students

Appendix A

A.1 Project Proposal Forms

Electrical and Biomedical 4BI6

Project Proposal

Design of Remote Sensing Instrumentation for the Study of Optical and Thermal Energy

by

Jane Elizabeth Doe (0123456)

Department of Electrical and Computer Engineering
Faculty Advisor: Prof. Smith

Electrical and Biomedical Engineering Project Report
Submitted in partial fulfillment of the requirements
for the degree of Bachelor of Engineering

McMaster University
Hamilton, Ontario, Canada
September 29, 200X

A.1.1 Project Summary

A.1.2 Progress to Date

A.1.3 Statement on Project Safety

A.1.4 Description of special facilities required in the project:

Table A.1: Services required for the project (Example)

Service	Requirement		Comment
Electrical Shop	Yes	No	
Machine Shop	Yes	No	
Special computing facilities	Yes	No	
Laboratory technician	Yes	No	
circle Yes or No			

Table A.2: Approval of services required in the project

Signing Authority	Signature
Electrical Shop Supervisor[1]	
Machining Services Supervisor[2]	
Computer Users Committee Chair	
Department Chair[3]	

Signature of Student: .....

[2]Machining Services will only provide estimates on the basis of clear, dimensioned sketches with appropriate detail (e.g. materials, purchased parts). Estimates cannot be provided in less than two days after date of request.

[1]Electronic Shop will not provide estimates without the signed approval of the project by the Advisor and outside of time specified in chapter 1, table 1.2 and page 4. Note that all material (components, printed circuit boards, loaned equipment, *etc.* must be returned to the Electronic Shop before the end of classes unless other arrangements have been made to purchase the parts.)

Comments of Faculty Advisor:

Signature of Faculty Advisor: ..... Date: .....

Comments of Project Co-ordinator:

Signature of Co-ordinator: ..... Date: .....

A.2 Progress Report Template

Electrical and Biomedical 4BI6
Project Progress Report

(Project Title)

(The above title will be used for Oral Presentation; maximum length is to be 40 characters, including spaces)

by

(Student's given names and family name (student number))

Department of Electrical and Computer Engineering

Faculty Advisor: Prof. (Advisor's family name)

Electrical and Biomedical Engineering Project Report (4BI6)
submitted in partial fulfillment of the requirements
for the degree of Bachelor of Engineering

McMaster University
Hamilton, Ontario, Canada
November X, 200X

A.2.1 Progress Report

(Progress report is to be approximately four pages long with the author's signature located at the end of the text)

Signature of Student: .....

Comments of Faculty Advisor:

Signature of Faculty Advisor: ..... Date: .....

Comments of Project Co-ordinator:

Signature of Co-ordinator: ..... Date: .....

A.3 Sample Abstract for Oral Presentation

ORAL PRESENTATION ABSTRACT

Design of an Electroocular Computing Interface

by
Jane Doe
Electrical and Biomedical Engineering

The human retina consists of an electrically-charged nerve membrane. This potential is a constant value for a given adaptation without stimulation; it is the retinal resting potential. The retinal resting potential causes an electric field around the eyeball, centered on the optical axis, which can be measured by placing electrodes near to the eye. As a result, the motion of the eye causes a measurable change of DC voltage between the surface electrodes. The same vector coordinate system employed in the modern computer mouse may be adapted for use with our electro-ocular interface. Such a device would provide a relative position of gaze and have application in both hands-busy and assistive research. The theory behind our device, hardware design, the experimental results, and efficacy of the system are presented.

Key words: electrooculography, EOG, human-computer interfacing, HCI, alternative computer input, hands-busy, assistive device

A.4 Sample Figure for the Final Report

In the report, a figure is placed in the middle of the textual part of the page. The figure's caption is at the bottom of the pictorial part and the text in the figure is *sans serif*, large enough to be legible. All the labels used in the figure are referred to in the caption, first in alphabetical then numerical order. All the acronyms (*eg.* BNC, RF) have to be defined in other parts of the report.

Figure A.1: Mobility chamber's supporting circuits (C_1, coupling capacitor for pulse generator, 0.1 μF, 400 V; C_2, filter capacitor, 470 pF, 250 V, polystyrene; R, resistor, 47 kΩ; 1, shielding enclosure; 2, terminal for monitoring oscilloscope, BNC (cathode, mobility chamber); 3, pulse input, BNC; 4, terminal for high input impedance amplifier, special RF (also anode of the mobility chamber).

A.5 IEEE Instructions for Short Presentations

The presentation time-constraint is important. At most IEEE conferences and meetings the maximum presentation time allocation was fifteen minutes. You can, in that time, speak some 1500 to 2000 words. In a fifteen-minute period you can expect your audience to absorb and recall (that is, learn) only about eight substantive and novel features of your work. Your paper probably deals with more than that. Each feature can be considered to be a separate thesis. A thesis, by definition is a statement to be explained. Although a maximum of eight theses (and there may be fewer) may appear to be a problem, actually the severely limited instructional band-pass of the presentation serves to simplify the speaker's chore. Since you cannot discuss all you've done, you discuss at most only the eight most important or interesting aspects of your topic.

Even eight theses soon will be forgotten without visual reinforcement. Audio-visual integration improves recall by a factor of three. Again, the requirements for visual reinforcement to achieve instruction efficiency simplifies the speaker's job. Each of the eight selected features should be presented as a thesis title upon a separate slide. The visual information then not only fixes audience attention, but serves to cue the speaker.

Another design constraint, imposed by the audience's data processing limitations, is that no more than six concepts can be treated on each slide. This would be a maximum of six blocks in the diagram, six steps in the solution, six features of the circuit, six characteristics of the system, six items on the sides of the matrix, and so on. That requirement of sub-set selection of six items best proving, or illustrating, the thesis of the slide again simplifies the speaker's task. In all, your speech preparation work consists of selection and simplification; that's always an easier job than origination.

Because the fact density per slide is necessarily light, it will be found that about one sentence of amplification per fact will serve to develop or prove the thesis of the slide. Six sentences normally run about 120 words, or one spoken minute.

Since the speaker who properly exploits the presentation medium is cued by the slides, and since the speaker certainly knows enough to be able to develop verbally any given thesis of any given slide for a least one minute, the cue cards or a written speech are not needed.

The alert reader will have noted an anomaly here. Eight slides is about ten

minutes, and the time frame for a talk is fifteen minutes. The missing four slides, or the time equivalent are to be used to title, to introduce, to summarize the topic developed by the eight-slide core and answer questions from the audience. Audience receptivity peaks at the beginning and at the conclusion of a talk. It is only common sense to exploit what psychologists call the "law of primacy and recency".

A.6 Engineering Design Contests

In addition to the work completed in 4BI6, a number of extramural competitions is open to students of engineering schools. Information regarding these events is available from the competitions' organizers.

- BEAM (Bio-electronics and Mechanics)
- Canadian Tunneling Association - Undergraduate Thesis Award
- CCA (Canadian Construction Association)
- CMC Design Competition (Canadian Microelectronics Corporation VLSI design competition)
- CSCE Computer Applications
- OEDC (Ontario Engineering Design Competition)

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