The University of the West Indies
Faculty of Engineering
Department of Electrical and Computer Engineering

Writing Manual

ECNG 3020 Special Project
2020/2021 Academic Year

University of the West Indies
September 2020
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1 Introduction
A key component of ECNG 3020 Special Project is the production of a final project report. This report is the means by which the findings of your project will be communicated to others. Keep in mind that the value of your study is correlated to how well it is communicated.

More often than not, too many students relegate the writing of their reports to the final days preceding submission. This is reflective of poor time-management and worse yet you can jeopardise your entire project, by either making it impossible to complete the report or by producing a sloppy document. Therefore, begin writing the moment you start your project – the literature review, scope, objectives and method are usually good starting points.

Writing is never a linear process – you will have to continuously review earlier sections as you produce later ones. A polished, comprehensive, succinct document is the product of dedicated review and several rewrites.

The experience gained in the writing of this report will be useful to the writing of journal articles, graduate theses or technical reports for industry. This writing resource provides guidelines for the completion of your ECNG 3020 Final Project Report.

In keeping with Section VII Of the UWI’s Assessment Regulations (2018), The Department permits re-marks of ECNG 3020. In a re-mark of your project, the “conduct” and “presentation” marks earned from the initial evaluation of the project go forward in the re-mark. While the evaluation of “understanding & comprehension”; “approach & methodology”; “report”; and “results” will be evaluated based on the report only.

The burden of evidence thus lies with the report. You are encouraged to produce quality reports that accurately and comprehensively capture the work done. Students who have produced weak reports have little chance of earning a higher grade, in the event of a re-mark.

2 Style, Quality and Writing Conventions

2.1 Style
Remember that your final report is a formal, scientific document. Style and tone are key considerations (see).
### Table 1: Tone

<table>
<thead>
<tr>
<th>Definition</th>
<th>Target</th>
<th>Examples</th>
</tr>
</thead>
</table>
| “Tone” refers to your attitude as reflected in the writing. Tone is conveyed largely through your word choices. | 3rd person perspective, objective and formal | Rather than: My (personal) method was a really (conversational good (opinionated) method.  
Recast: Results indicate that there is merit in the method. (This is objective, as it is supported by evidence-the results you presented) |

### Table 2: Style

<table>
<thead>
<tr>
<th>Definition</th>
<th>Target</th>
<th>Examples</th>
</tr>
</thead>
</table>
| “Style” refers to correctness in the application of appropriate writing conventions or rules. | Standard English as used in the Engineering Sciences | Rather than: There wasn’t enough testing to justify the design. (Contractions are inappropriate in formal writing)  
Recast: There was not enough testing to justify the design.  
Rather than: The data acquisition process in the computer aided design (CAD) industry (unnecessary word) is a rather (matter of opinion) tedious and time consuming process (both convey similar ideas-choose the more familiar or all encompassing one) which requires a high degree of skill due to necessary adjustments that need to be made in order to obtain (look out for strings of verbs: they result in longwinded unclear language) a Non-uniform rational B-spline (NURBS) model from the digitised data (This is long and the meaning is unclear)  
Recast: The data acquisition process in computer aided design (CAD) is tedious. It requires a high degree of skill to obtain a Non-uniform rational B-spline (NURBS) model from the digitised data. (Your aim is to create precise meaning, using clear language) |

- Prefer short over long. Choose the quickest way to convey information
- Prefer the simple over the complex. Choose simple sentence structures, and familiar ways of organising information
- Prefer the familiar over the unfamiliar. Choose familiar words over words that may be unfamiliar to your intended audience. Where you use a term that may be new to your audience provide a definition. Prefer familiar ways of organising information—how reports are typically organised; how Software Requirements Specifications are typically presented.
### 2.2 Quality Writing

Your final written report is a **technical document**, meeting **specific technical information needs**—it conveys your **method; approach; findings**. Indices of **quality technical information** are itemised in Table 3. Use the checklist in **Appendix A – Final Report Checklist** to review your report.

#### Table 3: Indices of Quality Information

<table>
<thead>
<tr>
<th>Easy to use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Orientation</td>
<td>Focus on the task at hand – to <strong>succinctly</strong> report the findings of your study.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Freedom from error – both in terms of the validity of the data presented and the grammatical correctness of your report.</td>
</tr>
<tr>
<td>completeness</td>
<td>Inclusion of <strong>all</strong> and <strong>only necessary information</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Easy to understand</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarity</td>
<td>Freedom from ambiguity – meaning must be gleaned from the first reading. Clarity and precision are largely determined by your word choices. Always aim for words which are unambiguous in meaning and prefer the familiar word over the unfamiliar.</td>
</tr>
<tr>
<td>Concreteness</td>
<td>Inclusion and integration of appropriate examples, illustrations, drawings, graphs etc. to aid understanding.</td>
</tr>
<tr>
<td>Visual appeal</td>
<td>Attractiveness and enhanced meaning through logical layout of content, easy to discern colouring, easy to read typography and clear and well-labelled non-textual items (diagrams, drawings, graphs etc.).</td>
</tr>
<tr>
<td>Style</td>
<td>Formal, Standard English. Correct application of appropriate <strong>writing</strong> and referencing conventions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Easy to find</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation</td>
<td>A clear hierarchy of information, using headings and sub-headings. Coherent arrangement of parts that makes the <strong>logical flow of ideas</strong> possible and the <strong>connection amongst ideas</strong> clear and apparent.</td>
</tr>
<tr>
<td>Retrievability</td>
<td>Presentation of information so that users can quickly and easily find pieces of information. Tables of content, tables of figures, etc., must be well-presented and accurate. All diagrams/tables/drawings must be captioned.</td>
</tr>
</tbody>
</table>


### 2.3 The Chicago Manual of Style

You are to use the citation conventions as set out in **the author-date system** of the Chicago Manual of Style 16th Edition or later. The Main Library provides a [Chicago Manual of Style quick reference](https://www.chicagomanualofstyle.org/).
3 Typography and Layout
Your ECNG 3020 final report will be testimony of your careful attention to detail and effort to present polished written work. Guidelines for the layout of your report are listed in Table 4.

<table>
<thead>
<tr>
<th>Order of Appearance</th>
<th>Items</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Title page</td>
<td>Use cover template. See Appendix B.</td>
</tr>
<tr>
<td>2</td>
<td>Statement of Academic Honesty</td>
<td>See Appendix C</td>
</tr>
<tr>
<td>3</td>
<td>Abstract</td>
<td>Place on its own page, Use single line spacing</td>
</tr>
<tr>
<td>4</td>
<td>Acknowledgements</td>
<td>Optional</td>
</tr>
<tr>
<td>5</td>
<td>Table of Contents</td>
<td>Place on its own page/s, Make use of white space to ensure that each item stands out, List only those items that follow the Table of Contents</td>
</tr>
<tr>
<td>6</td>
<td>List of Figures</td>
<td>Place on its own page/s, Make use of white space to ensure that each item stands out</td>
</tr>
<tr>
<td>7</td>
<td>List of Tables</td>
<td>Place on its own page/s, Make use of white space to ensure that each item stands out</td>
</tr>
<tr>
<td>8</td>
<td>List of Abbreviations</td>
<td>Place on its own page/s, Order items alphabetically, Make use of white space ensuring that items stand out</td>
</tr>
</tbody>
</table>

### Front Material
All pages in the front material, except the title page, are numbered. Use common Roman Numerals, at the top centre.

### Body
All pages from the introduction onwards, are numbered using Arabic numbers, placed at the bottom right. Numbering is continuous from the front material.

You may have chapter variations, either more chapters or differently named chapters: These need to be verified by your Supervisor. However you name your chapters, you must have an introduction; chapters that substantially treat with the literature, methods, results, analysis; and a conclusion.

### End Material
All pages in the end material are numbered using Arabic numbers, placed at the bottom right. Numbering is continuous from the body.

| 15 | References | Place on its own page/s, Do not number the reference section like a chapter. Title the page “References” and use the same font as Level 1 Headings, List all references according to the author-date system of Chicago Manual of Style 16th Edition or later, Use single-line spacing within each item, but double spacing between different items, so that each reference is distinct, Use a hanging indent for each reference |
| 16 | Appendices | Order appendices in the order that they are referred to in the body, Place each appendix on its own page, Label each appendix alphabetically – Appendix A etc. |
Invest effort and care in the overall presentation of your report. Aim for a professional finish by adhering to these guidelines:

- Print your report on letter size white paper
- Print on both sides of the page
- Leave a margin of 3 cm at the left-hand side of the page, to allow for binding, and 2.5 cm on the right-hand side, top and bottom
- Type the report using a 12-point, Serif font, such as Times New Roman
- Centre-justify chapter headings; left-justify levels 2-3 headings and justify body text
- Use appropriate software, such as Microsoft Visio™, to create diagrams and circuits which could then be imported into your report. **No part of the report should be hand-written or hand-drawn**
- Print an initial copy of your report and review for errors and formatting inconsistencies. Remember that actual print looks different from your electronic version. When you are satisfied with your final product then proceed to print the copy for submission. **Please note that a professional finish requires ample time for careful review. DO NOT leave your printing for the day of submission**
- Print your covers on either green A4-sized Bristol Board or A4 white sheets with transparencies
- Use the services offered by Faculty’s Printing Room to bind your final report. You may use comb binding or velo binding.

4 Content

4.1 Report Length

The report should be **no more than 80 pages** (i.e. from the title page to the end of your conclusion, discounting references and appendices). Students will be penalised for exceeding this limit, as deductions will be made from marks awarded for “Conduct”. If, for good reason, you expect that the body of your report will exceed this limit then apply for a waiver of this requirement. Formal application for a waiver **must be made thirty (30) days ahead of the final report submission. Written justification** is to be provided by the student and approved by the First and Second Examiners of the project (see Appendix D). Applications for waivers should be submitted to the Course Coordinator. A decision on the request for waiver would be communicated to the student within one (1) working week of having submitted the application.
4.2 Components of the Report

The guidance provided here is generic and requires adaptation based on your project type and project deliverables. Consult your Supervisor on the main content items of your report.

You may have chapter variations, either more chapters or differently named chapters: These need to be verified by your Supervisor. However you name your chapters, you must have an introduction; chapters that substantially treat with the literature, methods, results, analysis; and a conclusion.

Typically, your report should include the following in the order provided here. Each item (which appears in bold) must start on a new page.

1. **Report Cover**: Include the following:
   - The project’s name or title
   - Student name and student identification number
   - Date of the report
   - Project supervisor’s name
   - Project Type

2. **Statement of Academic Honesty**: The final report will be incomplete without a signed plagiarism form (see Appendix C) and will not be accepted.

3. **Abstract**: The abstract provides a concise, yet comprehensive overview of your work in 250 - 300 words. Here is a guide:
   a. In 1-2 sentences, outline the background of the project
   b. Give the aim of the project in 1-2 sentences
   c. Summarise the method in 1-2 sentences
   d. Report the major results/outcomes of the study in 1-2 sentences
   e. Conclude with 1 sentence giving the most significant outcome
   f. Revise the abstract to ensure that it is coherent and precisely written

4. **Acknowledgements**: Including this is a matter of personal choice. You may thank persons who have been supportive, or you can dedicate your work to someone.

5. **Table of Contents**: The Table of Contents allows for retrieval of information. It should list chapters, sections and sub-sections in your report. (see Figure 1)
Table of Contents

List of Figures .................................................................iii
List of Abbreviations ........................................................iv

1.0 Introduction ..................................................................5
  1.1 Background ...............................................................5
  1.2 Scope .........................................................................6

Figure 1: Sample Table of Contents

6. List of Figures: All figures should be listed in the order that they appear. It follows therefore that the numbering of figures within the body of the report should be in ascending order: Thus, Figure 1 is followed by Figure 2.

7. List of Tables: List all the tables that are in your report. Tables, like figures, should be appropriately captioned, and ordered so that Table 1 precedes Table 2.

8. List of Snippets: If you have integrated snippets of code into your report, then you are to list the snippets in its own page, within the front material.

9. List of Abbreviations: This page provides list of abbreviations used in your report. Abbreviations are ordered alphabetically. Provide the abbreviation first followed by the complete term (refer to figure 2).

List of Abbreviations

NST - Non Spanning Tree
PLC - Programmable Logic Control
Y - Wye

Figure 2: List of Abbreviations
10. **Introduction**: A comprehensive introduction must include:
   - **The background to the study** - what issues led to your investigation/design/analysis?
   - **The justification** – why is your work important, relevant or how is it different?
   - **The objective/s of the project** - what does your project aim to achieve or what problem/s does it seek to solve?
   - **The scope of your project** - what is the focus of your study? What is the extent of your project? What aspects of the research problem will be investigated?
   - **Literature Search (Type I projects ONLY)**: See 4.3 Project Variations by Project Type.
   - **The organisation of your report**. Give a brief description of each chapter in your report—typically one paragraph made of single sentences describing each chapter following the introduction.

11. **Literature Review**: For **Type I projects**, your Literature Review Chapter should be replaced with a Key Concepts Chapter, where you explore and define the concepts that are central to your project. See 4.3 Project Variations by Project Type.

    For **Type II Projects**, your Literature Review Chapter may be renamed “Background Theory”. See 4.3 Project Variations by Project Type.

    This is a review of established knowledge which is relevant to the topic. It may include a critical account of more recent work, an exposition of theory and the technique/s used for the practical work. The writer should bear the overall objectives of the report in mind while writing this section and should eliminate any material which is not directly relevant.

    An effective Literature Review summarises and evaluates seminal as well as recent scholarly literature that is germane to your study. It considers: How that literature has contributed to your area of research? What are the strengths and weaknesses of previous studies? How does the literature inform your understanding of the problem and your approach to the project?

12. **Method**: You should detail, in one or more chapters, the strategies/methods/procedures you used to arrive at your outcome/s. Explore and explain the theoretical side of the methods you have used. Depending on the nature of your project you may need to account for critical methodological aspects such as design, implementation, data acquisition and analysis.

    As it relates to major components and software used in your solution, you need to justify the selections that you have made. See Appendix E.
You must include a technical risk analysis. See Appendix F. This can complement your component and software selection.

In your method chapter, you must complete an Environmental Health Safety Risk Assessment. See Appendix G.

Since each project is unique you should consult with your project supervisor on how to treat with your method.

13. **Results**: In this chapter you present the results obtained. Significant elements of your results would be key equations, drawings, designs, spreadsheets, graphs, performance specifications and other data sets that have been generated by your work. In the case of projects which have implemented systems, a substantial section on testing is essential.

14. **Discussion**: In this chapter you analyse and evaluate the results of your project with special reference to relevant theory and or previous research – does your project confirm or disconfirm previous work? Account for the findings made, and any anomalies that may have arisen. Discuss the significance of your project outcomes.

15. **Conclusion**: The conclusion is a comprehensive summary of the major findings of your project. Discuss the major outcomes of your project as well as any limitations or shortcomings. In the conclusion you can recommend new directions or areas for future research.

16. **References**: References should be listed in accordance with the Chicago Manual of Style 16th Edition or later. Every source of information (journal article, book, online article etc.) used in your study must be listed. To do otherwise may invite charges of plagiarism (see Section 5 of this manual).

17. **Appendices**: The appendices must appear in the order in which they are introduced in the text. Each should bear a clear descriptive title and associated letter. e.g. Appendix A: Pattern Recognition Module; Appendix B: Pattern Matching Module. Each appendix must start on a new page. Appendices are used to place information that is related to but not vital to the arguments/findings being presented in the text. For example, if you used a large raw data set, your supervisor may ask you to include this in an appendix. Of course, your carefully selected, analysed data presented in appropriate form (graph; tables; etc.) that support your claims must be presented in the body of the report, where appropriate. Bulky appendices, such as programs, which make your final report too large and unwieldy, may be referred to in the body of your report but stored in a CD Rom. When you reference an appendix placed on a CD ROM, make sure that the in-text link is explicit, such as “See Appendix B (CD ROM)”. Next order files on the CD-ROM into folders, such as “Appendix A: Pattern Recognition
4.3 Variations by Project Type

Each project is unique, and it is impossible to prescribe exactly how each report should be organised and presented. However you organise your report, please consult your supervisor: Provide your supervisor with a mock-up of your report for their feedback. Do not expect that they will tell you how to organise your report! This is an unreasonable, insupportable expectation.

Here are some recommendations for organising your report based on project type.

**Type I:** A Type I project is a substantial literature review toward some stated end—recommendations or a conceptual model, for example. Therefore, you are to present your substantial literature review in several chapters, where each chapter focuses on a major theme or issue emerging from the literature. Type I projects test your understanding, analysis and synthesis of the literature. It is critical that the literature informs the way in which you organise and name parts of your review—the content and sequencing of content must be easy to follow; sensible; and demonstrate sound understanding the material.

In a Type I project, your method may be viewed as consisting of two elements belonging to different parts of the report:

1. **How you selected and limited your research.** This does not require lengthy treatment, perhaps three to four paragraphs in your Introduction (See 4.2 Report Components)

   You should explain how you conducted and limited your research:
   - Which databases did you use and why?
   - What key words did you use for your search?
   - What publication period did you examine? (Only new millennium research?)
   - How did you select the seminal papers you examined?
   - Did you limit your research by geography or other limiting parameters? (Only research on power grids in small-island developing states, for example)
   - Did you limit your search by discipline speciality? (Only Journals that are substantively microprocessor systems engineering journals, for example)
   - How is the literature organized?

2. **How you arrived at your stated conclusions.** The second element of your method—how you arrived at your stated end—is critical. This may be treated with in a standalone chapter or may be integrated into your chapters.

   It is not sufficient to simply re-state previous findings, rather you are critically reviewing previous studies, using stated measures or ways of evaluating, toward
a particular goal—policy formulation, conceptual models, identifying research niches, evaluating systems.

Your method chapter describes and explains your “stated measures or ways of evaluating”. Your method is determined entirely by your objectives. Here are some possibilities:

- Assuming you are asked to propose a conceptual model, then your method will be a detailed account of how you arrived at your model. Which pre-existing models did you examine and how did you evaluate them? Which variables have you included in your model and why?
- Assuming you are asked to evaluate various systems or algorithms towards making recommendations, then your method describes the measures or heuristics you used to evaluate them. How did you compare each system or algorithm with the other? On what basis do you make your recommendations?

**Type II:** Since Type II projects draw largely on the material taught in the degree programme and do not require extensive reviews of the literature, you may regard your second chapter as treating with background theory. In this case, title the chapter “Background Theory” and account for the theory and engineering practices which inform your project.

**Type III:** Type III projects require substantial literature reviews which lead to a working prototype or the development of a system. Your research may be a project outcome and you may regard it as part of your results; however, it is best treated in the Literature Review chapter. Here the chapter must be appropriately decomposed into subsections so that there is support for the design decisions and approaches that you take, and for your testing and evaluation strategies. Further your research must be linked to the rest of your report: You can expect to provide, in the relevant chapters, brief summaries of the literature in support of your design; to explain your testing; to validate for your results.

### 4.4 Non-text items

You should be **very selective of the non-text items** that you present in the body of the report. If you choose to include an item, it should be **vital to the point that you are making or illustrative of the work done**. For example, numerous screen shots of a GUI that you developed are unnecessary and indicative of poor writing: select and present a few which best represent the work that you have done.

Graphs, illustrations, figures and equations that **relate directly** to your discussion should be **well integrated in the main text** in which you have made reference to them (see Figures 3 - 4). As a general rule no more than a page should separate the
discussion from the non-text item (that is the graph, illustration, figure, table, equation etc.) If the non-text item is not directly related to your discussion but is nonetheless useful you should place it in your appendices.

Once the grid partitioning option was applied at the beginning of training, a uniformly partitioned grid was taken as the initial state (see Figure 3).

Figure 3: Uniformly Partitioned Grid

For easy reference, equations should be centred and numbered by using numbers placed in square brackets. Mathematical symbols should be set in an italicised font (see Figure 5). This can be done using the Equation tool in Word™.

The output of the 6th layer is the summation layer and it is the sum of all the outputs of the 5th layer and it is given by:

\[ O_{6,i} = \sum \bar{w}_i f_i = \frac{\sum w_i f_i}{\sum w_i}, i = 1, 2, 3, 4 \quad [11] \]

Figure 4: Equation Integrated into Text
Extensive tracts of code are called “Listings”: If you need to share these with your examiner, listings should be placed in your appendices. Extracts of code, less than half a page in length, can be included in the body of the report to demonstrate a particular point—that the code is unique in some way. You should caption these extracts as “Snippets” (see Figure 5). All code should be written using an appropriate monospaced font, such as “Courier New”.

OPEN and CLOSE might be implemented by inline functions or pre-processor macros; they would carry out their functions by memory-mapped IO, special instructions, or via a co-processor interface (See Snippet 1).

```c
unsigned strlen ( const char* s )
{
    unsigned i;
    unsigned e1 = OPEN(s, 100, 0);
    for (i = 0; *s != '\0'; i ++, s ++) {}  
    CLOSE ( e1 );
    return i;
}
```

Snippet 1: Programmer-directed usage of OPEN and CLOSE

Figure 5: Code Integrated into Text

5 Ethics

ECNG 3020 must not be regarded merely as a means toward the award of a degree. Rather, it must be thought of as an opportunity for professional and personal development and achievement. You are to spare no effort in ensuring the integrity of your work (please see Appendix C). You are bound by the following academic obligations:

- You must provide both in-text and bibliographic citation in accordance with the Chicago Manual of Style 16th Edition or later. Failure to do so will be taken as an attempt to plagiarise. Plagiarism is a grave offence and will attract severe penalties, as outlined in regulations of the University.

- Authentic research data are to be presented. Manipulation of results is regarded as a serious offence, whether it involves falsifying results or distorting them to fit expectations and will attract severe penalties as set out in the regulations of the University.
## Appendix A – Final Report Checklist

<table>
<thead>
<tr>
<th>Index of Quality</th>
<th>Description</th>
<th>Items for Action (attend to each item separately and in turn)</th>
</tr>
</thead>
</table>
| **Easy to use**  | **Task Orientation:** Single focus - **succinctly** and **completely** report on your findings. | • Review the **content** requirements of the report – consult manual, supervisor’s notes, marking scheme  
• Make a list of **what** you need to report on  
• Determine if you have covered them |
| **Accuracy:**    | Freedom from error – validity of the data and grammatical correctness | • Ascertain if your results are verifiable  
• Determine if they need further testing/validation  
• Report **truthfully**  
• **Review** for grammatical errors; ask a trusted person to review your work. |
| **Clarity:**     | Freedom from ambiguity – meaning is clear from the first reading. | • Review for clarity – ask yourself if you have chosen the best word and the best sentence structure to convey meaning. Opt for familiar words and simple sentence structures. |
| **Concreteness:**| Inclusion of appropriate examples, illustrations, drawings, graphs etc. to aid understanding | • Show evidence when necessary (illustrations, graphs etc).  
• Ensure that **all required non-text items** are **well integrated and captioned** |
| **Visual appeal:**| Attractiveness through easy to discern colouring, easy to read typography and clear and well-labelled non-textual items (diagrams, drawings, graphs etc.). | • Verify that you have used double line spacing for the body of your report  
• Ensure that you use single line spacing for references, long quotations that are set apart from text and appendices  
• Choose 12-point TNR or another simple serif font for body text and Sans Serif font for headings  
• Ensure that all equations, graphs, circuitry are generated by and inserted using appropriate software – no hand-written insertions |
| **Style:**      | Correct application of appropriate **writing** and **referencing conventions**. | • Verify that you have used standard notation where required  
• Review your report for tone – it should be formal. Eliminate colloquialisms and contractions. Avoid using the first-person perspective  
• Review your both in-text and end of text citations. Ensure that they adhere to the CMoS |
| **Easy to understand** | **Organisation:** Coherent arrangement of parts that makes the **logical flow of ideas** possible and the **connection amongst ideas clear and apparent.** | • Ensure that your chapters and sections are appropriately ordered and labelled  
• Review each chapter to ensure that ideas are logically ordered and adequately developed  
• Use transitions, such as ‘first’, ‘next’, ‘then’, to connect ideas and provide guideposts for the reader |
| **Retrievability:** | Presentation of information for quick and easy retrieval. Tables of content, tables of figures etc. must be well-presented and accurate. | • Verify pagination – front material in Roman numerals, everything else in Arabic  
• Check the accuracy of your table of contents, list of tables, list of figures, list of symbols  
• Ensure that chapters are appropriately headed, appendices are labelled, non-text items are captioned |
THE UNIVERSITY OF THE WEST INDIES

B.Sc. (Engineering)
Department of Electrical and Computer Engineering
ECNG 3020 – SPECIAL PROJECT

PROJECT TITLE
FINAL REPORT

Jamie Solomon
808000001

October 16 2008

Project Supervisor: Dr. Krishna Ram
Project Type: I
Appendix C – Statement of Academic Honesty
(The Portal provides a Word™ version)

THE UNIVERSITY OF THE WEST INDIES
ST. AUGUSTINE, TRINIDAD & TOBAGO, WEST INDIES
FACULTY OF ENGINEERING
Department of Electrical & Computer Engineering
B. Sc. in Electrical & Computer Engineering

CHEATING, PLAGIARISM AND COLLUSION DECLARATION FORM

According to Rules 3.31 and 3.32 of The UWI Faculty of Engineering Undergraduate Regulations and Syllabuses 2018/2019:

3.31 “Cheating, Plagiarism and Collusion are serious offences under University Regulations.
(a) Cheating is any attempt to benefit one’s self or another by deceit or fraud.
(b) Plagiarism is the unauthorised and/or unacknowledged use of another person’s intellectual efforts and creations howsoever recorded, including whether formally published or in manuscript or in typescript or other printed or electronically presented form and includes taking passages, ideas or structures from another work or author without proper and unequivocal attribution of such source(s), using the conventions for attributions or citing used in this University. Plagiarism is a form of cheating.
(c) For the purposes of these Regulations, ‘collusion’ shall mean the unauthorised or unlawful collaboration or agreement between two or more students in the preparation, writing or production of a course assignment for examination and assessment, to the extent that they have produced the same or substantially the same paper, project report, as the case may be, as if it were their separate and individual efforts, in circumstances where they knew or had reason to know that the assignment or a part thereof was not intended to be a group project, but was rather to be the product of each student’s individual efforts.

3.32 Cheating, plagiarism and collusion shall be reported to the Campus Committee on Examinations and the penalties would be in accordance with the University Examination Regulations.”

I, …………………………………………………………………………, have read and understood Rules 3.31 and 3.32 of The UWI Faculty of Engineering Undergraduate Regulations and Syllabuses 2018/2019 on Cheating, Plagiarism and Collusion.
I understand that my submission is subject to the electronic plagiarism checker, Turnitin.
I declare that this assignment is my own work and does not involve cheating, plagiarism or collusion.

Signature:…………………………………………… Date:……………………………
## Appendix D – Application to Waive Page Limit

*(The Portal provides a Word™ version)*

<table>
<thead>
<tr>
<th>Student Name:</th>
<th>Student ID:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor:</td>
<td>Second Examiner:</td>
</tr>
</tbody>
</table>

### Project Title:

1. Provide a brief description of your project:

2. List your project’s goals/ objectives:

3. Define the scope of your project:

4. Justify the need for increased project length and provide an estimate of the expected length of your report:

------------------------------------------------------------------------------------------------------------------
**First Examiner** | **Date**
------------------------------------------------------------------------------------------------------------------
**Second Examiner** | **Date**
Appendix E - Components and Software

All projects must include justification for major components and software used; and a bill of materials (See Table 5).

For major components/ software, you should use a table, comparing at least three (3) possible alternatives that could be used to achieve a specific task (temp/flow/humidity/luminance sensors). This comparison table should be supported by a rationale that adequately details why the component/software was chosen. For example, if you had to measure the flow of water from a pump, you should provide a comparison table with alternative flow meters evaluated against several metrics (error, flow rate, price, and type). You should then provide a rationale detailing why one was chosen based on the metrics, your project objectives and any other design consideration that you have established as being important (such as cost, or durability). Here is an example:

*Flow meter X may be cheaper and more precise than flow meter Y, but research (customer reviews, etc) show that flow meter Y is far more reliable in terms of lifespan.*

Even in the case where a particular component is specified by the project supervisor, you should examine alternatives so as to comment on the adequacy of the given component.

Here are some examples of inadequate justification:

1. A light sensor capable of measuring the illuminance (lux) on the plants was required to provide data to be used for analysing plant growth. For this application, the TSL2561 lux sensor was used. The TSL2561 is a light-to-digital converter that transforms light intensity to a digital signal output capable of direct I2C. This was interfaced via the I2C protocol to the Raspberry Pi.

   When the student indicated that a light sensor was used, they did not compare it to any other types of light sensors or sensory techniques. They also did not relate it to their project objectives, demonstrating that it was the best possible solution.

2. Flow sensors were required for alarm monitoring purposes. They were used as a binary indicator to determine whether or not there is flow. These sensors were attached to the outputs of the pumps and the solenoid valves to check for failures. For this application, Hall-effect flow sensors capable of measuring vertical gravity flow were used.
Here the student does not indicate what specific flow sensors were used and provided no comparison table. The use of the sensors was not related to the objectives nor requirements of the project.

**Table 5: Bill of Materials Template**

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Item Code</th>
<th>Quantity</th>
<th>Serial Number</th>
<th>Manufacturer</th>
<th>Date Approved</th>
<th>Paid for by DECE</th>
<th>Paid for by Student</th>
<th>On loan from Supervisor</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
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(please tick)
Appendix F – Technical Risk Assessment
(The Portal provides a Word™ version)

As part of your ECNG 3020 project, you are required to manage technical risk. Technical risk is the likelihood that an element or elements of a system or design do not meet its performance requirements, and, if there is a shortfall in performance, how serious the shortfall is likely to be.

Here is a resource that may be useful:


Note that though the author labels the content as “Risk Management”, in general, the risks that he identifies are very good examples of technical risks as opposed to ESH risks.

Managing technical risk is crucial to project success. It involves three steps: identifying, assessing and addressing technical risk. You must complete a Technical Risk Assessment and Mitigation Worksheet. To assess a risk use Table 7.

Table 6: Technical Risk Assessment and Mitigation Worksheet

<table>
<thead>
<tr>
<th>Technical Threat</th>
<th>Risk Score</th>
<th>Mitigation Strategy</th>
<th>Details of Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Choose one:</td>
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<tr>
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<td></td>
<td>Eliminate/reduce/accept?</td>
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<td>Choose one:</td>
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<td>Eliminate/reduce/accept?</td>
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<td>Choose one:</td>
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<td></td>
<td>Eliminate/reduce/accept?</td>
<td></td>
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</tbody>
</table>

Table 7: Technical Risk Assessment Scores

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Significant</th>
<th>Moderate</th>
<th>Low</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
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<td></td>
<td>0.7</td>
<td>0.5</td>
<td>0.3</td>
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<td>0.9</td>
<td>0.7</td>
<td>0.6</td>
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</tbody>
</table>


Appendix G – ECNG 3020 Risk Management Form

(The Portal provides a Word™ version)

You are required to manage Environmental, Safety and Health (ESH) risks. This form helps you to identify and address risks that may arise in your project. Since each project is unique, you will have to adapt this instrument as needed. You must complete this form in conjunction with your supervisor and co-supervisor (where applicable). You are to excise the explanatory material and present the completed instrument/s only in your final report.

Risk management involves three stages—identifying, assessing, and mitigating risks. This risk management form is a living document which is likely to change as your project evolves. Working with your supervisor, you are to revise this document as needed. All your risk management forms must be archived in your Log Book. Each version, ahead of all practical activity, needs sign-off from your Supervisor and Co-supervisor (where applicable). You are to account for risk in your method and provide, at minimum, the final risk assessment document in an appendix. Where there were major methodological changes prompted by managing risk, it may be worthwhile to account for these changes: The extent of and the placement of the account are subject to the advice of your supervisor.

Here are the definitions of the risk assessment terms as used in this instrument:

- **A hazard** is any source of potential damage, harm or adverse impact on something or someone.

- **ESH Risk** is the chance that a person or resource will be harmed or adversely affected as a result of some particular action. Risk has two dimensions: the likelihood of the occurrence of harm; and the severity of that harm.

- **Risk analysis** is the identification of possible risks and their consequences.

- **Risk assessment** is the evaluation of risks in terms of their likelihood and severity.

- **Risk mitigation** has three main strategies—avoidance, reduction, and acceptance. Avoidance is removing the probability of occurrence by eliminating the action or material that carries risk. Reduction is dampening the severity of repercussions. Acceptance is bearing the risk.

Here are some useful resources:


  This resource provides examples of electrical work tasks and safe work practices.


  This resource provides procedures to achieve minimum acceptable standards for electrical safety-related work practices.
ECNG 3020 Risk Management Form

PART I: Version Control

<table>
<thead>
<tr>
<th>Version Number</th>
<th>Date of Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

PART II: Project Identification

Project Student:

Project Title:

Project Supervisor:

Project Objectives:

Provide an overview of the project’s methodology:

Describe the tasks involved in carrying out the practical work (attach additional pages/documentation as needed):

PART III: Projects at a Workplace

This section relates to capstone projects that involve protracted research activity at a workplace external to The Department of Electrical and Computer Engineering (e.g. an industry partner). Such a project involves frequent work, at minimum two times per month, at the industry site.

Name of Project Supervisor:

Name of Co-supervisor (industry based supervisor):

Job Title of Co-supervisor:

Company Name:

Company Address:

Contact details of Co-supervisor:

Provide details of the OHS Workplace Safety Program that is in place at the location where the work will be carried out:
PART IV: Projects involving Field Work

This section is applicable to projects that require field work. Field work is any data collection exercise that is not classroom or laboratory based. Field work may include visits to industries, but such visits are not regarded as regular and ongoing at a fixed place of work.

Title of field work:

Period of field work

- [ ] One time  Date:
- [ ] Multiple, specified  Dates:
- [ ] Multiple, unspecified  Number:  Date range:

Persons involved in field work

<table>
<thead>
<tr>
<th>Name</th>
<th>Role (student/UWI Staff accompanying student/Field Trip Facilitator)</th>
</tr>
</thead>
<tbody>
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</table>

PART V: Hazard Identification

This section is applicable to all projects. Please complete the hazard identification matrix.

<table>
<thead>
<tr>
<th>Hazard Identification Matrix (Tick all that apply)</th>
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<tbody>
<tr>
<td>Will you come into contact with or use:</td>
</tr>
<tr>
<td>[ ] Industrial plant/equipment/machinery</td>
</tr>
<tr>
<td>[ ] Ionising radiation sources or equipment</td>
</tr>
<tr>
<td>[ ] Powered electrical devices/machinery</td>
</tr>
<tr>
<td>[ ] Lifts/hoists/cranes</td>
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<tr>
<td>[ ] Pressure vessels/boilers</td>
</tr>
<tr>
<td>[ ] Biological material</td>
</tr>
<tr>
<td>[ ] Hazardous chemicals</td>
</tr>
<tr>
<td>[ ] Compressed gas</td>
</tr>
<tr>
<td>[ ] High Voltage/High Current Transmission Lines</td>
</tr>
<tr>
<td>[ ] Falling objects</td>
</tr>
<tr>
<td>[ ] Any other hazardous material or equipment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does you project involve:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Using tools/equipment with moving parts</td>
</tr>
<tr>
<td>[ ] Using tools/equipment that vibrate</td>
</tr>
<tr>
<td>[ ] Using tools/equipment that ignite</td>
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<tr>
<td>[ ] Using heavy equipment</td>
</tr>
<tr>
<td>[ ] High voltages</td>
</tr>
<tr>
<td>[ ] Working with human subjects</td>
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<td>[ ] Working with biological specimens (tissue; body fluids; live or dead animals; bacteria; viruses etc.)</td>
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<tr>
<td>[ ] Working at a height</td>
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<tr>
<td>[ ] Working with high powered EM radiation</td>
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<tr>
<td>[ ] Any other hazardous activity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In the course of carrying out your project work will you encounter:</th>
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<tbody>
<tr>
<td>[ ] Loud or continuous noise</td>
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<tr>
<td>[ ] Dust/fumes/gases/loose particles or fragmented material?</td>
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<td>[ ] Extreme temperatures</td>
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<tr>
<td>[ ] Slippery surfaces/trip hazards</td>
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<tr>
<td>[ ] Exposed electrical wires</td>
</tr>
<tr>
<td>[ ] Any other HSE threat</td>
</tr>
</tbody>
</table>

List any other hazardous material or equipment:

List any other hazardous activity:

List any other hazardous working condition:
PART VI: Hazard Assessment and Mitigation

This section **applies to all projects**. For each hazard; hazardous activity; or hazardous working condition use the matrices below to assess the risk, then complete the Risk Assessment and Mitigation Worksheet.

### RISK LEVELS

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Extremely high risk. Unacceptable levels of risk. Major disruption. Detailed risk management strategies MUST be applied in order to reduce or eliminate the extremely high risk level to a satisfactory level. This is high priority. Organisations should consider ways to modify the elimination unacceptable risks. If risk cannot be reduced, the task should be prohibited.</td>
</tr>
<tr>
<td>H</td>
<td>High risk. Potentially serious risks. Some disruption. Proactive risk management strategies are required so that the risk is reduced. No work is to start/continue without the implementation of risk management strategies.</td>
</tr>
<tr>
<td>M</td>
<td>Moderate risk. Reduced or degraded capability. Organisations should consider what can be done to manage the risk to prevent any negative outcomes.</td>
</tr>
<tr>
<td>L</td>
<td>Low risk. Expected losses have minimal or no impact. Organisations can proceed with these activities as planned. Risk can be managed with simple/routine procedures.</td>
</tr>
</tbody>
</table>

### PROBABILITY / LIKELIHOOD

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequent</th>
<th>Likely</th>
<th>Occasional</th>
<th>Seldom</th>
<th>Unlikely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Either occurs often or is continuously experienced</td>
<td>Occurs frequently or several times in life cycle.</td>
<td>Occurs sporadically or a few times in life cycle.</td>
<td>Some remote possibility in the life cycle.</td>
<td>Possible but improbable. Probably will not occur in life cycle.</td>
</tr>
<tr>
<td>CATASTROPIC</td>
<td>E</td>
<td>E</td>
<td>H</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>CRITICAL</td>
<td>E</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>L</td>
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<tr>
<td>MARGINAL</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>L</td>
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<tr>
<td>NEGLIGIBLE</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
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<tr>
<td>Risk Priority</td>
<td>The Risk What can happen and How it can happen</td>
<td>Time frame Duration for which the risk exists</td>
<td>Severity Rating</td>
<td>Probability/Likelihood Rating</td>
<td>Risk Level Rating</td>
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PART VII: Personnel Sign-Off

By signing below, all personnel agree with the field/workplace conditions outlined and acknowledge receipt of safety instructions.

Student Name (block letters):
Student UWI ID:
Student Signature:
Date:

Supervisor Name (block letters):
Supervisor Signature:
Date:

Co-supervisor Name (block letters):
Co-supervisor Signature:
Date: