COMPUTERS IN ENGINEERING
PROJECT MANUAL
CMP1003

2018 Edition

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Electrical and Computer Engineering
SCHOOL OF ENGINEERING

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1 SUMMARY

First Year Bachelor of Engineering students at the University of Technology, Jamaica, are required to complete a Project as part of their course work requirements for the Computers in Engineering Module. To start the process, the students are required to select a project from a list provided by the Lecturer. The students are then required to work in groups of two to five and may consult with any Lecturer, Tutor or Technologist that is assigned to the Module at an appropriately arranged time.

To complete the project, the students are required to plan and design a software, write a report on the project, and orally present the findings in a presentation which is held in **week fourteen (14) of semester one.**

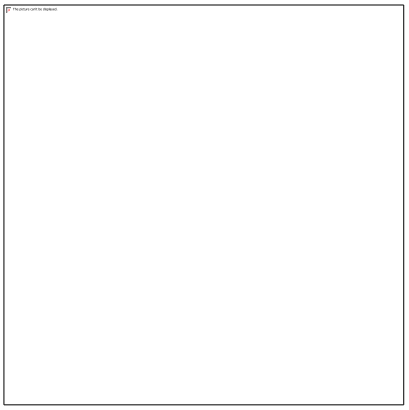
The purpose of the project is to introduce students to the practice of proper project management and to enable them to develop a better understanding of their program of studies, with an emphasis on the application of the theory learnt over the semester. It also enables the student to synthesize and to broaden their experiences in the methodology of research and problem solving. The project lasts the entire semester and has no exempting qualifications.

The rest of the document gives detailed explanations of what is required to complete the project.

2 ENGINEERS WRITE TOO

2.1 Writing in Engineering

Whether you are studying Chemical, Civil, Electrical, Materials, or Mechanical Engineering, the ability to write clearly and persuasively is important in both your studies and your future career as an engineer.



2.2 Writing technical reports

In Engineering, one of the major forms of communication is the technical report. At universities, reports are read by lecturers and tutors (or technologists in the case of UTECH) in order to assess your mastery of various topics and your ability to apply your knowledge to a practical task. In the workplace, they will be read by managers, clients, and the engineers responsible for building from your designs. The ability to produce a clear, concise, and professionally presented report is therefore a skill you will need to develop in order to succeed both at university and in your future career.

While reports vary in the type of information they present (for example, original research, the results of an investigative study, or the solution to a design problem), all share similar features and are based on a similar structure.

This document contains the conventional format for reporting the results of your research, investigations, and design projects in THIS COURSE.

2.2.1 Key features of reports

Reports:

- are designed for quick and easy communication of information
- are designed for selective reading
- use sections with numbered headings and subheadings
- use figures and diagrams to convey data

2.2.2 Basic structure of a report

A report usually has these components:

- Title page
- Summary
- Table of Contents
- Introduction
- The body of the report
- Conclusions
- References
- Appendices

2.3 Title page

This page gives:

- the title of the report
- the authors' names and ID numbers
- the course name and number, the department, and university
- the date of submission

The title of the report should indicate exactly what the report is about. The reader should know not only the general topic, but also the aspect of the topic contained in the report. Compare the following pairs of titles:

2.4 Sample title page

This section contains the framework sections of a first-year Engineering concept design report. A good and a weak example are given, to begin, choose the most informative title for the report yourself.

Engineering Physics I PHS1005
School of Engineering
University of Technology

[Option A]
ALTERNATIVE DESIGNS REPORT
THE FUEL CELL CAR

[Option B]
TWO ALTERNATIVE
CONCEPTUAL DESIGNS

Lee Binks (1264789), Penny Jinks (1299345) and Hong Links (1350433)

Date submitted: June 5, 2015

2.5 Summary

The summary (sometimes referred to as the **executive summary**) provides a brief overview of the substance of the report; usually no more than half a page. It is not an introduction to the topic. The summary should outline all the key features of your report, including the topic, what you did and how you did it, and the main outcomes of your work. A busy manager who might not have time to read the full report should be able to get the gist of the whole report by reading the summary.

The summary:

- states the topic of the report
- outlines your approach to the task if applicable
- gives the most important findings of your research or investigation, or the key aspects of your design
- states the main outcomes or conclusions

The summary does NOT:

- provide general background information

- explain why you are doing the research, investigation or design
- refer to later diagrams or references

2.6 Sample summary

Read the following summaries and select the best one for the report.

2.6.1 Summary A

The aim of this project is to design a car using fuel cell technology. The technology is investigated and an outline of two designs is given. Each design is suitable for a different market, but both are designed to the same criteria. Sketches are provided for each design.

2.6.2 Summary B

Two alternative designs for a fuel cell powered car are presented.

Car A, which uses hydrogen fuel, is a sedan designed for the executive market. It provides extra luxury for the driver, but is spacious enough for family use. Car B, powered by hydrogen and oxygen, is a medium sized hatchback which offers a range of features for the family. While both cars are efficient for short trips, they lack the range and speed desirable for long journeys.

Both cars incorporate similar safety features and fulfil the design criteria of having low exhaust emissions and using environmentally friendly materials; however, Car B is recommended as it has slightly lower power consumption and is more economical to manufacture.

2.7 Table of contents

The contents page sets out the sections and subsections of the report and their corresponding page numbers. It should clearly show the structural relationship between the sections and subsections. A reader looking for specific information should be able to locate the appropriate section easily from the table of contents. The conventions for section and page numbering are as follows:

- Number the sections by the decimal point numbering system:

1.0 Title of first main section (usually Introduction)
    1.1 First subheading
    1.2 Second subheading
2.0 Title of second main section
    2.1 First subheading
    2.2 Second subheading
        2.2.1 First division in the second subheading
        2.2.2 Second division in the second subheading
3.0 Title of third main section

- Number all the preliminary pages in lower-case Roman numerals (i, ii, iii, iv, ...). You don't have to place the number *i* on the title page. Just count it and put *ii* on the second page of your report. Preliminary pages are any which come before the introduction, including the summary and, where applicable, acknowledgements.

- Number all the remaining pages of your report with Arabic numerals (1, 2, 3, 4, ...). Thus the report proper begins on page 1 with your introduction, which is usually Section 1.
- Provide a title in your table of contents to describe the contents of each appendix (Note: one *appendix*, two or more *appendices*). Don't just call them Appendix 1 or Appendix 2.

2.8 Sample contents

Look at the following tables of contents and select the best one for this report.

2.8.1 Contents A

Contents

	Summary		ii
1.0	**Introduction**		1
2.0	**Car A**		1
	2.1	Design features	1
	2.2	Materials selection	2
	2.3	Fuel efficiency	2
3.0	**Car B**		3
	3.1	Design features	3
	3.2	Materials selection	4
	3.3	Fuel efficiency	4
4.0	**Comparison of designs**		5
5.0	**Conclusions**		8
6.0	**References**		9
	Appendices:		
	Appendix 1 Design diagrams		
	Appendix 2 Contribution of each group member		

2.8.2 Contents B

	Summary		1
1.0	**Background**		1
2.0	**Car A design**		2
3.0	**Car B design**		4
4.0	**The materials we selected**		5
5.0	**What are the safety features?**		7
	5.1	Car A	7
	5.2	Car B	7
6.0	**Discussion**		8
7.0	**Conclusion**		9
8.0	**References**		9
9.0	**Appendix 1**		10
	Appendix 2		11

2.9 Introduction

The introduction provides the background information needed for the rest of your report to be understood. It is usually half to three-quarters of a page in length. The purpose of the introduction is to set the context for your report, provide sufficient background information for the reader to be able to follow the information presented, and inform the reader about how that information will be presented.

The introduction includes:

- the background to the topic of your report to set your work in its broad context
- a clear statement of the purpose of the report, usually to present the results of your research, investigation, or design
- a clear statement of the aims of the project
- technical background necessary to understand the report; e.g. theory or assumptions
- a brief outline of the structure of the report if appropriate (this would not be necessary in a short report)

2.10 Sample introduction

Read the following introductions and select the best one for this report.

2.10.1 Introduction A

Introduction
The purpose of this project is to introduce our group's two conceptual designs. We have included the following sketches for each car: 3 dimensional view, elevation, plan, front, rear and interior view. Also, we have included a discussion of how the designs meet the criteria given in the project outline. The cars could be suitable for short trips in busy areas.

2.10.2 Introduction B

1.0 Introduction
With the rise in global warming and increasing pollution levels, it is becoming essential to find a viable alternative to the internal combustion engine petrol powered car.

The aim of this project was to create two designs for a fuel cell powered car, the main criteria being environmental friendliness in terms of both emissions and materials.

This report presents the designs for two such cars, each of which includes the following components: engine, fuel, wheels, accessories, safety features and materials. Car A is aimed at the upper end of the market, while Car B is a mid-range vehicle suitable for family use.

A description of the design and an analysis of operational efficiency for each car are followed by a comparison of the two designs. Finally, the most cost efficient design is recommended.

2.11 Body of the report

This is main part of the report, where you present your work. The introduction and conclusions act as a frame for the body only: therefore all the details of your work (including a summarised version of material in the appendices) must be included here in the appropriate section. You will need to put some thought into the ordering of the sections; the presentation of information should flow logically so that the reader can follow the development of your project. It is also essential that you choose concise

but informative headings and subheadings so that the reader knows exactly what type of information to expect in each section.

The body of the report:

- presents the information from your research, both real world and theoretical, or your design
- organises information logically under appropriate headings
- conveys information in the most effective way for communication:
    - uses figures, tables and equations
    - can use bulleted or numbered lists
    - can use formatting to break up large slabs of text

2.12 Headings in the body of the report

Provide informative headings

As for the title, section headings should tell the reader exactly what type of information is contained in the section. They should be specific and content-focused rather than just labels. Devising informative headings as opposed to label headings right from the planning stage will help you to clarify exactly what you want to achieve in each section and subsection. Compare these pairs of headings:

Example: Uninformative headings

- The Organization
- Management

Example: Informative headings

- Overview of the Organization
- Communication in the Organization
- Groups in the Organization
- Management Style and Methods

Make all headings consistent and parallel in structure

This means that headings should follow a similar grammatical form. In the following example, each heading is structured differently:

Example: Inconsistent headings

- The Company Structure
- Do the Communication Channels Work?
- Participating in Groups
- How to Develop an Effective Management Style

- [*noun phrase*]
- [*question*]
- [*gerund phrase*]
- [*instruction heading*]

Usually, it is not difficult to convert such headings to a common form. In this example, all have been changed to *noun phrases*. This is the most commonly used format for section headings in an informational report.

Example: Consistent headings

- Company Structure
- Communication Channels
- Group Participation
- Development of an Effective Management Style

2.13 Sample headings

Which of the following section headings are grammatically consistent?

2.13.1 Option 1

- 2.0 Car A
  - 2.1 The Materials we selected
  - 2.2 Emissions
  - 2.3 How the safety features Work
  - 2.4 What Accessories are included?

2.13.2 Option 2

- 2.0 Car A
  - 2.1 Materials selection
  - 2.2 Emissions
  - 2.3 Safety features
  - 2.4 Accessories

2.13.3 Option 3

- 2.0 Car A
  - 2.1 The Materials Selected
  - 2.2 Emissions
  - 2.3 safety features of the car
  - 2.4 Accessories included

2.14 Incorporating figures, tables, and equations

There are conventions for using figures and tables in a report. Usually only these two categories are used; anything other than tables (maps, charts, diagrams, drawings, graphs) is called a figure. Figures and tables should be placed as close as possible to the point at which they are referred to in the text.

Give all figures and tables a number and title.

Example
Table 1 Existing communication channels

Refer to each figure and table in the text of the report.

Example
The communication channels in the organization are shown in Table 1.

The title of a table goes above the table, while the title of a figure goes below the figure.

Example

Table 1Turning volume of pedal cycles

	(1)	(2)	(3)	(4)	(5)
8:00 - 8:15am	0	0	1	0	1
8:15 - 8:30am	0	0	1	1	0
8:30 - 8:45am	0	0	3	1	0
8:45 - 9:00am	0	0	2	3	1
Total Volume	0	0	7	5	2

Figures that are copied from someone else's work, published or unpublished, must be correctly referenced. Give the source of the diagram or the data if you have taken them from published sources. The citation should be placed in brackets after the figure or table title, and the source included in the References list.

Example
The relationship of the speed of propagation and the volumetric tissue fraction is given by:

Figure 1 Phase shift keying modulation (source: Mercator GPS Systems, 1998)

2.14.1 Equations

You will often have to include equations in your reports. The conventional style for presenting equations is as follows:

- Centre the equation on the page
- Place the equation number in round brackets at the right-hand margin
- In the text of your report, refer to the equations as either Eq. (1) or equation (1). Use whichever format you choose consistently throughout your report.

The relationship of the speed of propagation and the volumetric tissue fraction is given by:

(1)

We can see from Eq. (1) that...

2.15 Conclusions

The conclusions section provides an effective ending to your report. The content should relate directly to the aims of the project as stated in the introduction, and sum up the essential features of your work. This section:

- states whether you have achieved your aims
- gives a brief summary of the key findings or information in your report
- highlights the major outcomes of your investigation and their significance

2.16 Sample conclusions

Read the following conclusions and select the best one for this report.

2.16.1 Example A

5.0 Conclusions
This report introduced two environmentally-friendly designs for a car. We presented information about the engine and fuel, materials, safety and accessories and provided sketches for each car. These cars would be more expensive than normal family cars, but it is important to develop cleaner technology for the future.

2.16.2 Example B

5.0 Conclusions
Two alternative designs for an emission-free fuel cell powered car have been presented: Car A, a luxury sedan which runs on hydrogen, and Car B, a medium-sized family hatch which uses hydrogen and oxygen. Each car features recyclable materials and conforms to global design standards in terms of performance and safety features. However, Car B is recommended as it was found to be more economical in terms of both manufacturing and running costs.

2.17 Referencing

The two parts to referencing are:

- **citations** in the text of the report
- a **list of references** in the final section

A **citation** shows that information comes from another source. The **reference list** gives the details of these sources. You need to use in-text citations and provide details in the references section when:

- you incorporate information from other sources; e.g.:
  - factual material
  - graphs and tables of data
  - pictures and diagrams

- you quote word-for-word from another work (when you do this the **page number** must be given in the in-text citation)

Example of in-text citation and reference list entry using the Harvard referencing style:

In-text citation

Corrosion is defined as a 'chemical action which harms the properties of a metal' (Glendinning 1973, p.12). Because corrosion reduces the life of the material and protection procedures are expensive, special corrosion-resistant metals have been developed, including Monel metals which are particularly suited to marine applications (Glendinning 1973).

Reference list entry

Glendinning, E.H. 1973 *English in mechanical engineering*, Oxford, Oxford University Press.

2.18 Appendices

These contain material that is too detailed to include in the main report, such as raw data or detailed drawings. The conventions for appendices are as follows:

- each appendix must be given a number (or letter) and title;
- each appendix must be referred to by number (or letter) at the relevant point in the text

Example:
The data obtained are summarised below. The detailed data are given in Appendix 3.

3 PROJECT LIST

3.1 Project 1: Casino Royale – Video Poker

Maximum Group Size (MGS): 4 **DUE DATE: TBA**

COURSE: COMPUTERS IN ENGINEERING

PART I (Video Poker)

Assignment Overview

The game of poker has been growing exponentially in popularity over the past few years, and shows no signs of stopping. Players continue flock to their favourite casinos and online poker rooms day and night to pursue their favourite pastime. This surge in popularity can largely be attributed to two factors: first, widespread poker coverage on television, and second, the increasing availability of games online, 24/7. According to PokerScout.com, there are over 64,000 cash game players raking hands online at any given time, and hundreds of thousands of tournament players competing for prize money day and night. Party Poker has gone from a tiny underground card room, to a massive, publicly listed company traded on the European stock market, all in the span of just a few years. Online poker is here to stay. Poker game apps can also be created for iPhone, iPad, BB etc.

Poker is played from a standard pack of 52 cards. (Some variant games use multiple packs or add a few cards called jokers.) The cards are ranked (from high to low) Ace, King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2, Ace. (Ace can be high or low, but is usually high). There are four suits (spades, hearts, diamonds and clubs); however, no suit is higher than another. All poker hands contain five cards, the highest hand wins.

The player's objective is to get the best hand possible. You are dealt five cards. To try to improve your hand, you can discard or hold any of your five cards. New cards are dealt to replace the discarded ones. If the rank of your final five-card hand is listed on the payout schedule, you win! The table on the top of the game window shows you the payoff for each betting level.

A good website to play this game is: http://www.flash-game.net/game/599/poker-machine.html

Task

Your task is to implement the poker machine game in MATLAB. Before implementing the game, please play the game on the website mentioned above. It will help you understand the project.

Program Specifications:

To play, first make a bet. You can either click the Bet button until you have bet the number of coins you desire (to a maximum of 5 coins), or click Bet Max to bet the maximum coins all at once. Then click the Deal / Draw button to distribute the cards. (When you have entered the maximum number of coins, the machine will deal automatically.)

You will be given 5 cards. Now you have a one-time option to draw additional cards to replace cards you discard. Evaluate your five cards and decide which, if any, you want to hold to achieve the highest ranked poker hand possible. You may hold cards by simply clicking on either the card or the Hold/Discard button. When you do so, the held cards will be displayed with a "Hold" sign under them. You can use keyboard to hold cards. Press 1 to hold first card, 2 to hold second card and so on. If you want to reselect a card just press the corresponding number again.
Once you have selected a given amount of cards to hold, click on the "Deal" button again. The cards that were not marked as "Hold" will be replaced. If after this replacement you have any combination of cards that qualifies for a payout, your credit will be increased by the amount of coins shown in the Win field.

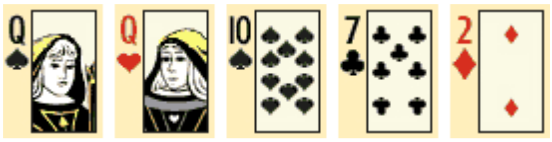
Payout Rankings:

Know the order of cards, from low to high- **Ace (A), 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack (J), Queen (Q), King (K) and Ace (A)**. The ace (A) can usually double as the lowest ranked card as well as the highest. Card suits do not affect ranking- for example, the king of hearts and the king of spades are equal. Final hands in poker are always based on the total rank of five cards.

Familiarize yourself with the definitions of different hands, and with the value of each type. The different categories of five-card poker hands are as follows, from weakest to highest:

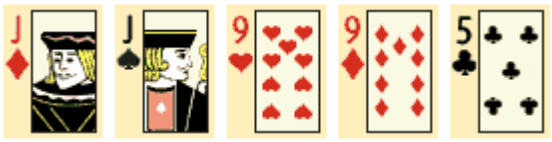
One Pair, Two pair, Three of a kind, Straight, Flush, Full house, Four of a kind, Straight flush and Royal flush. A given hand beats all hands listed before it.

1. **One pair** consists of two cards out of a five-card hand with the same numerical rank. For example: Q-Q-10-7-2 (a pair of queens), or J-J-8-5-3 (a pair of jacks).



5 POINTS

2. **Two pair** consists of two different pairs of cards and one other card in a five-card hand. Examples of two pair hands are A-A-K-K-5 (two pair, aces and kings, 5 kicker), and J-J-9-9-5 (jacks and nines, 5 kicker).

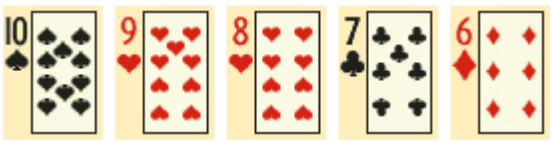


6 POINTS

3. **Three of a kind** consists of three cards of the same numerical rank in a five-card poker hand. Examples of three of a kind would be A-A-A-3-2 (three of a kind aces), and Q-Q-Q-7-2 (three of a kind queens).

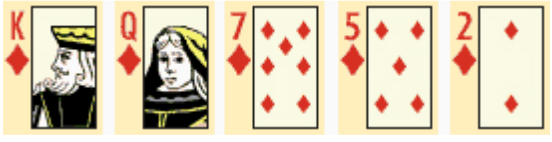
7 POINTS

4. **Straight** consists of five cards in sequential order, of different suits. For example, 6-5-4-3-2 is a straight. 10-9-8-7-6 is a straight.



8 POINTS

5. **Flush** consists of five cards in non-sequential order, all of the same suit. For example, A-9-7-5-2 of hearts is heart flush. K-Q-7-5-2 all of diamonds is a diamond flush.



10 POINTS

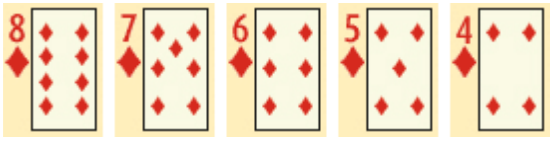
6. **Full House** consists of three cards of the same numerical value, as well as a pair. It is useful to think of a full house as containing both three of a kind and a pair. For example, A-A-A-5-5 is a full house, aces full of 5's. 6-6-6-2-2 is a full house, sixes full of 2's.

25 POINTS

7. **Four of a kind** consists of four cards of the same numerical rank, and any other card. An example of four of a kind would be, Q-Q-Q-Q-5 (four of a kind, queens).

50 POINTS

8. **Straight Flush** consists of five cards in sequential order, all of the same suit. For example, 8-7-6-5-4 of diamonds is a straight flush.



100 POINTS

9. **Royal Flush** consists of A-K-Q-J-10, all of the same suit. A royal flush is simply the highest possible straight flush- however because of its very high value, it is given a separate name. The suit of the royal flush does not matter- all of them are equal.

1000 POINTS

10. None of the above. **0 POINTS**

PART II (Playing the Double Up)

After getting a winning hand you will be given the chance to double the payout, or to collect your winnings. To collect your winnings, click the "No" button. If you want to try and win more, click the "Yes" button. You will be given another hand of five cards. The dealer's card will be exposed, while the remaining four cards will be left face down. Hold one of them. If the card you chose is higher than the dealers' card, you will win the double amount of your original payout. You will then be given the chance to double your payout again or to collect your winnings. If your card is of the same rank, it is a tie, and you will have a chance to collect your original winnings or to double up. Otherwise, you lose and will not receive any payout.

If you have collected your winnings you can begin another hand.

ASSESSMENT FORMAT: You will be required to present and demonstrate your solution to a panel that will assess and grade your work, the breakdown of the grades will be sent later. Each group member must contribute some amount of code to the project and be prepared to explain and defend their part of the code at the presentation.

You will also be required to submit a report that should be formatted according to the standards described in ENGINEERS WRITE TOO.

4 PROJECT MARKING SCHEMES

4.1 Overall Project Assessment

Category	Grading Criteria for Project	Rubric Scores	Your Score
Project Presentation (80% of total score)	Rank score obtained using the Project Presentation Evaluation Rubric out of 80.	80	
Project Report (20% of total score)	Rank score obtained using the CMP1003 MATLAB Code Evaluation Rubric out of 20.	20	

4.2 Presentation Assessment Mark Scheme

Category	Grading Criteria for Project Presentation	Rubric Scores	Your Score
Quality of the Presentation (20% of total score	• Clarity of expression (2) • Use of presentation aids (2) • Deportment and delivery (2) • Diction and Grammar (2) • Confidence and Knowledge (2)	10	
Technical Content (60% of total score)	• Level of sophistication (2) • Application of theory (4) • Extent of design/ data analysis/calculations (4) • Individual's technical role in the project (4) • Functionality/Specifications (4) • Documentation (4) • Readability (4) • Efficiency (4)	30	
Question, Answer and Discussion (20% of total score)	• Correctly answered questions (2) • Understanding of the Project (2) • Understanding of Project Management (2) • Quality and depth of knowledge (2) • Confidence and alertness (2)	10	

4.3 Project Report Evaluation Rubric

Category	Grading Criteria for Project Report	Rubric Scores
Overall Project Report not including Figures and Tables (20% of total score)	The report is extremely well organized, properly formatted according to the standards outlined in ENGINEERS WRITE TOO, and are easy to follow. Discussion in each report section is relevant and complete. There are no grammatical or spelling errors.	4
	The report is reasonably easy to read and complete. There are minor formatting and/or grammar problems.	3
	The report is readable only with significant effort. There are significant sections in the report either missing or significantly incomplete. There are major formatting and/or grammar problems.	2
	The report is poorly organized and difficult to read. There is little effort to address basic report requirements.	1
	Only a minimal effort is made for the majority of the sections within the report.	0
Figures and Tables (10% of total score)	All figures and/or tables are complete, detailed, properly formatted according to the standards outlined in ENGINEERS WRITE TOO. Figures and/or tables provide useful information in a logical format. Captions are completely consistent with the associated figure/table. There are no grammatical or spelling errors.	4
	Figures and/or tables are mostly complete and detailed. Captions are consistent with the associated figure/table but could be improved. There are minor formatting or detail omissions that would have improved user understanding of the purpose of the figure/table. There may be limited grammar or spelling errors. Relevant standards are not completely followed for one or more figures or tables.	3
	The figure or table is incomplete or some portions are not readable. There are many spelling and/or grammar errors that detract from the figure/table.	2
	The figure or table is mostly incomplete or most portions are not readable. There are a significant number of spelling and/or grammar errors that detract from the figure/table.	1
	The figure/table is completely unreadable or provides no useful information. Relevant publication standards are ignored.	0
Test and Documentation (10% of total score)	The design test process is extremely well documented. Documentation describes tests that were performed, anticipated results, and observed results. A justification is given for all tests performed. Debugging and corrections to the design are described with respect to how conducted tests revealed design errors.	4
	The design test process is documented with minor omissions. Documentation does not describe all tests that were performed, anticipated results, and observed results. Some test justifications are omitted. Only some debugging and corrections to the design are described.	3
	The design test process is documented with a number of omissions. Documentation describes few tests that were performed, anticipated results are not discussed, or observed results are omitted. Little test justifications are given. Little to no debugging and corrections to the design are described.	2
	The design test process is documented with a significant number of omissions. Documentation describes few tests that were performed, anticipated results are not discussed, or observed results are omitted. No test justifications are given. No debugging and corrections to the design are described.	1
	The design was not tested or the tests were not documented.	0