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Presentation · February 2017

DOI: 10.13140/RG.2.2.35266.02246

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HOW TO WRITE A TECHNICAL REPORT?

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A Technical Report –

Written work product required to present facts and conclusions of a project.

Includes technical concepts and visual depictions of designs and data.

Convey information in an objective, fact-based manner—a style that ensures technical information and processes that can be relayed from you to readers in a clear, efficient fashion.

Should include the steps you followed or the events that occurred; **your opinions should not make their way into the text.**

Writing of Technical Report is very important !!

- A graduation project is not accompanied with a software, then the documentation would be the evidence of the project,
- Good project work (software for example) could be ruined by a poor report.

Remember:

- Usually, readers will have a technical / engineering background, but it is the responsibility of a report writer to explain the specifics of the subject of the experiment, process, or project.
- The immediate audience is the Professor / Supervisor evaluating your understanding of theoretical concepts. Others may be fellow students, engineering colleagues, or customers seeking engineering services or products.

Factors to be considered for writing report --

- ✓ Who is going to read the report?
- ✓ What is the level of their current knowledge?
- ✓ How much information is needed?
- ✓ What background information to include?
- ✓ Why is the reader reading the report?
- ✓ Is the document supposed to inform or convince?
- ✓ How much time does the reader have to read it?

EXTERNAL STRUCTURE

Professional technical reports should have a scientific approach, typical external structure and formal style.

Elements of technical report in Prescribed format

Cover page

Title page

Preface

Executive Summary/ Abstract

Dedication

Acknowledgements

Table of contents

List of tables

List of figures

Nomenclature

Introductory chapter

Central chapter(s)

Conclusions

Tables*

Figures*

Appendices

References**

Bibliography

* Alternatively, the tables and figures may be placed in the main text instead of at the end (both approaches may not be used in the same report).

** In a report with few, short or no appendices, the list of references can follow immediately after the conclusion.

- A report is like a story -- it must have a beginning, middle and an end, but the middle is the actual story.
- The external structure does not only relate the sequence of the elements, but also relate the relationships between the elements and the importance and size of each.
- The introduction must not be too long.
- Emphasis should be placed on the central chapters.
- Central chapters must not be overpowered by the appendices.
- The conclusions should follow the central chapters in a justifiable manner.

APPROACHES TO WRITING

The approach of writing ---

Top-Down Approach

Evolutionary Delivery

Top-Down Approach

- Use Chapter Breakdown Structure to identify the structure of the report
- Identify all chapter names, sections and sub-sections
- Identifying the contents of each chapter, makes writing much easier
- Concentrate on a certain target in each chapter, and do not misdirect to another target
- Helps in time management

Evolutionary Delivery

- Write separate parts of the reports as the thoughts come by.
- You can re-write these parts as your project proceeds, and your information increase.
- So, each part evolves and matures over a period of time as new ideas immerge.

These two approaches, Top-Down and Evolutionary Delivery, can be combined –

- by specifying the chapters, sections and sub-sections headings and contents.
- by considering it as road-map, you can start writing these parts, taking into consideration any probability of re-writing that might be needed while the project in progress.

Cover Page

- The purpose of the cover page is to identify and protect the report.
- It must contain the title, the initials and surnames of the authors, the date, the name of the department and institution, and the emblem of the institution.

Note : For using Emblem take necessary permission from the authority.

Title Page

The title page contains --

- ✓ All the information given on the cover page (except emblem).
- ✓ Status of the report, for example “Technical Report: Part 1” or “Final Report for Mechatronic Project”.
- ✓ If it is done under the guidance of a teacher, the name of the supervisor must also be indicated.

Executive Summary / Abstract

- Engineering professors typically require either an Executive Summary or an Abstract with technical reports, but not both.
- The executive summary should give a concise and clear overview of the entire project or topic.
- Readers should be able to gain all necessary information from the Executive Summary and sometimes will read this part only.

Preface

Purpose of the preface –

- ✓ To place the report in context of the degree.
- ✓ To allow a statement that all the work that has not been attributed to others is your own.

Dedication

- ✓ This is a short sentence, in the middle of a separate page, in which the report is dedicated to a family member, friend or acquaintance.
- ✓ It may be left out and is seldom included in short technical reports.
- ✓ It is more suited to theses.

Acknowledgements

Here, you can acknowledge

- other people (technicians, typists) directly involved in the execution
- organizations / institutions provided money or facilities

Table of Contents

- ✓ The table of contents must begin on a new page.
- ✓ The page is provided with a heading, such as ‘Contents’ or ‘Table of Contents’.

List of Tables and List of Figures

These lists, arranged according to the table and figure number along with relevant page number in the right-hand column.

Each list should begin on a new page.

The titles of tables and figures must be descriptive enough so that a specific figure or table can be identified in the list.

Nomenclature

The list of the symbols used must begin on a new page.

The list is arranged in the sequence ---

- ✓ All the ordinary symbols are to be listed first, followed by the superscripts and then the subscripts.
- ✓ Finally, the auxiliary symbols: overbar and underscore for vectors and averages or accent marks for time-dependent components, are to be listed.

Introduction

The introductory chapter should provide –

- The context in which the report originated, i.e.
 - ✓ the work from which it originated,
 - ✓ how it links to / differs from preceding or related work,
 - ✓ the limitations that were placed on the work, and so forth.
- The purpose of the report, i.e. the problem that was examined and the specific objectives of the work.

- The motivation for the work or report, that is, why the work was undertaken.
- The introduction will contain a general overview of previous work in the field and definitions of words or expressions that have a specific meaning.
- An overview of the rest of the report is sometimes provided.

Remember

Care should be taken during formulation of the objectives. The objective should be such that the Conclusions section can answer the question:

Has the objectives been reached?

Central Chapter(s)

- The structure of the central chapters depends on the contents of the report.
- Every chapter should be focused on one topic, i.e. it should have a clear purpose.
- The title of the chapter normally reflects the purpose.
- The contents of the central chapters must remain strictly linked to the purpose of the report.
- Contents with marginal importance should preferably be placed in the appendices.

During writing chapters consider the following:

- ✓ Introduction: the purpose of the chapter, and how it links to the purpose of the report.
- ✓ Underlying or simplified assumptions.
- ✓ Analytical or numerical theory used, or the procedure for the investigation.
- ✓ Measured results, results of the analysis or observations (verifiable results).
- ✓ Processing of results: method and answers.
- ✓ Interpretation of results.
- ✓ Conclusions: usefulness and importance of results; how the results contribute to achieving the purpose.

- The central chapters do not usually follow the chronological sequence of the project.
- Each conclusion drawn in the conclusions must be corroborated in the central chapters.
- A consequence of the scientific approach is that each statement must satisfy one of the following:
 - The statement is obviously true.
 - The statement is proven in the report.
 - The statement is motivated in the report.
 - A reference to a source that has made the statement before is given with the statement.

Conclusions

Purpose is to make it clear to what extent the purpose of the report was achieved and which findings were made.

All statements in the Conclusions must be supported in the report.

Guidelines for the contents are:

- Summarize the purpose of and the motivation for the project.
- Clarify to what extent the purpose was achieved.
- Provide a summary of each chapters indicating how these chapters contributed.

- Summarizes the most important findings, methods or techniques.
- Discuss the implications of the findings and indicate the contributions made by the report.
- Emphasize the most important findings.

Tables and Figures

- Tables are used --
 - ✓ For quantitative comparisons.
 - ✓ When the differences between lines on a graph will be too small.
 - ✓ When the relationship between the dependent and independent variables is not clear.
- Figures (all drawings, sketches, graphs and photos) can be used to interpreted the subject mater easily.

Appendices:

- Appendices are used for long mathematical formulas and complete sets of data such as tables or figures.
- All appendices should be referenced within the text.
- Items in the appendices should be arranged in the order in which they are mentioned in the report itself.

References

Citations show that information comes from another source.

The list of references gives the details of these sources.

Citations is required when

✓ We incorporate information from other sources:

- factual material
- graphs and tables of data
- pictures and diagrams

✓ We quote word-for-word from another work.

Note: Do not include any reference in reference list which have not referred in the report.

Bibliography

- A bibliography is a list of sources, usually books, that provide a broad background on the topic, but to which no specific reference is made.
- Only comprehensive technical reports, such as some theses, have a bibliography.

MICROSTRUCTURE

Just as the report, every chapter, and even every paragraph, also has a structure –

- an introductory section
- a central section
- a conclusion

Even a paragraph can have an introductory sentence, a central section and a concluding sentence.

A chapter and a paragraph should also have a specific purpose.

Style

Style is a wide-ranging and complicated topic.

Some of the important guidelines for style are ---

- Use formal and concise language.
- Only use the third person. If unavoidable, the authors can be referred to as ‘the authors’.
- Each sentence must be a complete sentence, i.e. must contain at least a subject and a verb, and often also an object.
- Do not link two sentences by means of a comma.

- Active sentence construction is more striking than the passive construction.
- Use the present tense for something that is still valid, but the past tense for something that happened in the past or is no longer valid.
- Use the most appropriate words or terms.
- Sweeping statements must be avoided, since they indicate that the author is uncertain or not knowledgeable.

- Irrelevant appendices are not at all permissible
- The author will keep the reader and his/her interests in mind. Remember, engineers are interested in results, not excuses: what was done, how was it done, and what does it mean.
- Sentences in which author gives instructions to reader, for example “Add eq. (3) and (4)” should be avoided.
- Explain less known abbreviations, for example ‘Jadavpur University (JU)’ when they are used for the first time.

- Common abbreviations should preferably be written out (“for example” rather than “e.g.”).
- Use Bulleted lists only when all the items in a list are of equal importance and when the sequence is not important.

Page Numbering

- Number all the preliminary pages in lower-case Roman numerals (i, ii, iii, iv,...).
- Do not place the number (i) on the title page. Just count it and put (ii) on the second page of the report.
- Number all the remaining pages of the report with Arabic numerals (1, 2, 3, 4,...). Thus the report begins on page 1 with the Introduction.

Style for Table of Contents

- The table of contents sets out the sections and subsections and their corresponding page numbers.
- Number the sections by the decimal point numbering system.
- Do not just call Appendix as Appendix 1 or Appendix 2. To describe the contents of each appendix provide a title, for example: Appendix 1: Sample Calculations.
- The page is provided with a heading, such as ‘Contents’ or ‘Table of Contents’, followed by a list of the three main levels of headings along with their page numbers.

1.0 Title of first main section (usually Introduction) ...	1
1.1 First subheading.....	2
1.2 Second subheading	2
2.0 Title of second main section	3
2.1 First subheading	4
2.2 Second subheading	5
2.2.1 First division in the second subheading ...	6
2.2.2 Second division in the second subheading	7
3.0 Title of third main section	8

Guidelines for paragraphs and sentences

- A paragraph should not be longer than 10 lines, because it is repulsive to readers.
- Begin a paragraph with a theme sentence. A theme sentence states the purpose or theme of a paragraph.
- Write paragraphs in such a way that the reader can distinguish between different types of paragraphs in terms of their purpose, for example the introductory paragraph, the explanatory paragraph, the linking paragraph and the concluding paragraph.
- Consecutive sentences of a paragraph, must be linked to one another.
- Place the main idea of a sentence in the main phrase.

Font

- Use a standard, 12pt, font, such as Times New Roman, for the main text.
- Use different font sizes, bold, italic and underline where appropriate but not to excess.
- Too many changes of type style can look very fussy.

Headings

- Heading and sub-headings are used to break-up the text and to guide the reader.
- They should be based on the logical sequence which you identified at the planning stage.
- The use of numbering and type size and style can clarify the structure:

3. METHODS OF HARNESSING WAVE ENERGY

3.1 Shore-Based Systems

3.2 Deep-Water Systems

3.2.1 'Duck' Devices

3.2.2 Rafts

References to diagrams, graphs, tables and equations:

- In the main text refer any diagram, graph or table which you use.
- **Label diagrams and graphs as follows:**

Figure 1.2 Graph of energy output as a function of wave height.

In this example, the second diagram in section 1 would be referred to by “....see figure 1.2...”

- Label tables in a similar fashion:

Table 3.1 Performance specifications of a range of commercially available GaAs FET devices

In this example, the first table in section 3 might be referred to by “...with reference to the performance specifications provided in Table 3.1...”

- Number equations as follows:

$$F(\text{dB}) = 10 \log_{10} F \quad (3.6)$$

In this example, the sixth equation in section 3 might be referred to by “...noise figure in decibels as given by eqn (3.6)...”

Put equations like $b = \sqrt{a/r}$ in a paragraph.

Do not put complex equations in paragraphs since you can't refer to them by their reference number, and it upsets the spacing in the paragraph. Write the complex equation and center the equation on the page:

$$b = \frac{q^3}{\sqrt{\sum_n b^n}} \quad (1.1)$$

Guidelines for the tables:

- Each column, and sometimes also every row, must have a title, with units, if applicable.
- Tables in the main text usually do not have more than a few rows because they otherwise contain too much information and becomes uncomfortable to reader. Larger tables should rather be included in appendices.

Guidelines for figures:

- Figures should usually cover half a page or an entire page.

General guidelines for graphs:

Graphs are used to show the trends or to compare a series of data.

- Graphs containing data that need to be compared (for example experimental, analytical and numerical) must be combined in the same figure to get direct comparison between the values.
- The quantity of information in one graph must be limited so that the different symbols can be clearly distinguished.
- Put independent and dependent variable on the horizontal and vertical axis respectively. The axes of a graph must be named in words, along with units.

Referencing style

The two parts to referencing are ---

- ✓ Citations in the text of the report
- ✓ List of references in the final section

Referencing methods –

- ✓ Alphabetic system
(Harvard-system uses this style)
- ✓ Numbering system
(IEEE uses this style)

- **In the alphabetic system**

Various references are listed alphabetically according to author in the reference list.

In the text itself, the author's/authors' last name(s) and the date of the publication are cited.

- **In the numerical system**

The references in the list at the end are given in a numbered list in the order in which they appear in the text for the first time.

In the text itself a reference would then be cited in the form of a number (usually in square brackets).

In the reference list, you should provide the details of each entry in the following manner:

- For a book: name of the authors, *title*, publisher, city of publication and year of publication.

(Taylor J. R., *An Introduction to Error Analysis*, Oxford University Press, Mill Valley, CA, USA, 1982)

- For an article in a journal: name of the authors, title, *name of the journal*, **volume** (issue number), range of pages, and year.

(Sen S. and Sarkar S., ‘Optimization of Combined Cycle Power Plants’, *Energy Conver. Mgmt.*, **42**(3), 359-371, 2001.)

- For an article in conference proceedings: name of the authors, title, *name of conference*, editors (if present), range of pages and year.

(Sen B. ‘Design, and Performance of a Dynamic System’, *Proceedings of National Renewable Energy Convention ’99*, Sawhney R.L. (Ed.), 9-15, 1999.)

- A chapter in a book: authors of the chapter, title of the chapter, editors of the book, *title of the book*, publisher, city of publication, range of pages, and year of publication.

(Sen G., Solar Power Stations, Veziroglu T.N. (Ed.), *Solar Energy and Conservation: Technology and Utilization*, Volume 2, Pergamon Press, NY, USA, 665-673, 1978)

- A report: authors, *title*, university/company, report number, year.

(Ahmed K., *Renewable Energy Technologies*, World Bank Technical Paper Number 240, 1994)

- A Ph.D. or Masters Thesis: author, *title*, department, university, year.

(Kedare S.B., '*Investigations on a Reciprocating Wind Machine*', Ph.D. Thesis, Dept. of Mechanical Engineering, IIT, Mumbai, 1991)

- A manual / handbook / standards : company name (if there are no authors), *title*, reference number, year.

(British Standards Institution, *Specification for Steel girder bridges*, BS153 : Parts 3B & 4 : 1972, 1972)

- A web-site : Author or Organization, *name of the site*, complete address of the site, date visited

(Danish Wind Industry Association, *Aerodynamics of Wind Turbines: Lift*, [http://www.windpower.org /tour/wtrb/lift.htm](http://www.windpower.org/tour/wtrb/lift.htm), Aug 16, 2002)

ORIGINALITY AND PLAGIARISM

- Any use or copy of other people's facts or ideas or any use of phrases, sentences or paragraphs, must be enclosed in quotation marks and referenced by a number. Otherwise, it is assumed to be plagiarized i.e. you have knowingly copied someone, passing them off as your own. This is a **serious offence**.
- If the person copied from is a fellow student, then this offence is known as collusion and is equally serious.
- This applies equally to information obtained from the Internet / websites.

- In such a case, will be sent to the Investigating Officer and you may be called before a disciplinary panel.
- However, examination boards can impose penalties for these offences ranging from loss of marks to disqualification from the award of degree.

PROOFREADING

- Proofreading refers to the checking --- from the content to the layout.
- After finishing, it have to check very carefully.
- We can check it by someone, e.g. one of your fellow students or a professional proofreader, for any errors in content, style, structure and layout. In such a case we should acknowledge the name of the person.

PRESENTATION

The presentation guidelines may be recommended are:

- **Script:** The report must be printed single sided on white A4 paper. Hand written or report printed using dot-matrix are not acceptable.
- **Margins:** All four margins must be at least 2.54 cm.
- **Page numbers:** Do not number the title, summary or contents pages. Number all other pages consecutively starting at 1.
- **Binding:** A single staple in the top left corner or 3 staples spaced down the left hand margin. For longer reports (e.g. Final year project report) use binders.

PROMPTS FOR WRITING CONSULTATIONS

Before finalizing, answer a few questions:

- Does the abstract summarize the point of the paper? The problem? The methods used? The results?
- Do the paragraphs within a section flow in a logical order?
- Do the ideas in each section flow from general to specific, big picture to small?
- Does the report show readers how an experiment was conducted or how a process was completed?
- Are the results written about so clearly that the process could be replicated exactly?

- Does the thesis sentence look similar to: “The purpose of this report is . . .?”
- Are tables, figures, and diagrams fully interpreted and understandable? Can readers grasp the significance of tables and graphs?
- Are tables, figures, and diagrams appropriately labeled and referred to within the text?
- Does the writer maintain objectivity? Is the paper free of editorializing—“I think,” “I feel”? Is the report free of most adverbs and adjectives?
- Is the writing clear and well-edited?

FINALLY REMEMBER

- ❖ *Writing is a creative process and powerful way to clarifying your thinking.*
- ❖ *Good writing doesn't happen overnight; it requires planning, drafting, rereading, revising and editing.*
- ❖ *Improvement in writing requires self-review, peer-review, subject-matter expert feedback and practice.*
- ❖ *Good writing is a habit that takes time to develop. There are no shortcuts; practice makes perfect.*
- ❖ *Happy Writing makes Happy Reading.*

THANK YOU