

## **General guidelines: Technical report (Seminar and Project) writing for Department of Energy Science and Engineering (DESE) Students, IIT Bombay**

### **What is a technical report**

Technical report is a structured report providing technical information about the topic in a logical flow. It has chapters, sections, sub-sections, definitions, equations, figures, tables, charts, all numbered systematically. Generally, it begins with introduction, followed by the subject matter with concluding remarks at the end.

### **How to gather technical information through reference**

Refer to abstracting and reviewing journals, engineering indices, index published in volumes of journals, references listed in books and other papers, internet search engines (specially the web pages of the related journals, e.g., sciencedirect.com, asme.org, idealibrary.com, acm.org/dl, journals.cambridge.org, oupjournals.org, catchword.com, metapress.com, google.com, springer.de, etc.).

Select and list down the complete reference after going through the abstract if it is relevant to your topic. Try to read the complete paper.

### **How to read a paper**

It is difficult to understand the paper at first reading. Do not get disheartened. Read the paper fully anyway. Read the paper a few times. Try to understand the approach, get a gist of the paper. Note down whatever you have understood, after reading the paper.

### **Managing a reference**

Take notes of the paper on separate foolscap sheets or in a note-book. Take care that all relevant referencing details are mentioned at the top of the page. Try to arrange them subject wise, approach wise, etc. from time to time. You prepare an index of references.

### **How to start writing the report**

Start organizing the various aspects of the topic in your mind. Write them down, rewrite them, change, rethink about them, rewrite them, ..... do not give up.

Try to write the content page. Start with chapter names. Fill in with section names. Further fill in with sub-section names. Start writing the sections that you are comfortable with.

Finally you will start seeing a common thread of logic. Try to perfect it.

### **Technical language**

- Be careful about the language used in the report.
- The report should be written in third person.
- Follow a logical thread in presenting the matter. For this purpose you will have to understand and arrange the content matter properly based on your notes.
- Use short and simple sentences.
- Do not use qualitative adjectives unless absolutely necessary. Instead, use quantitative parameters and numbers properly defined.

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- Think of the reader while writing the report. Ask yourself : Will the reader be able to understand clearly ?
- Always give credit to the original author by citing the reference whenever you are using any material from the reference.
- Use consistent methods of numbering references, figures, tables, sections, through out the report. Do not mix them up.
- Use only SI system of units through out the report.
- Avoid short-forms and parentheses as far as possible.

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## **GUIDELINES FOR REPORT WRITING**

**1. Title Page.** First page of report. Try to find a title that clearly describes the work you have done and be as precise as possible. Mention your name, role number, guide's (and co-guide's) name, name of the department (i.e. Energy Systems Engineering), name of the institute, place and month and year of the report.

**2. Abstract.** On a separate page, immediately following the title page, summarize the main points of the report. Persons getting interested in the report after reading the title, should be able to judge from the abstract whether the report is really interesting for them. So, briefly formulate the problem that has been investigated, the solutions derived, the results that have been achieved, and your conclusions. The abstract should not occupy more than one page (about 150 to 200 words). This page should precede the content page.

**3. Table of Contents (TOC).** Should list only those items that follow it appearing in the following order.

- List of tables (1.1, 1.2, 1.3..., 2.1, 2.2, .. etc.)
  - List of figures (1.1, 1.2, 1.3..., 2.1, 2.2, .. etc.)
  - Nomenclature : necessary whenever the number of symbols exceeds 0. This is in order of English (i.e., Roman) letters (Uppercase followed by lowercase), Symbols in Greek letters (see Appendix for the alphabetical order of Greek letters), subscripts and superscripts used, Special Symbols, followed by acronyms (i.e., Abbreviations) if any; everything in alphabetical order. All entries in nomenclature should have appropriate units in SI system.
  - The chapters (1, 2, ... N, followed by the name of the chapter),
  - Sections within chapters (e.g. 1.1, 2.4, etc. + name)
  - Subsections within sections (e.g. 1.1.1 + name)
  - Appendices (I, II, III, IV, .. etc. + name), if any
  - References
  - Acknowledgements : if you feel like it. Remember that acknowledgements are in order only in the final report. That is, not in M.Tech. I and II stage reports, but in the final M.Tech. dissertation.
- and
- The page numbers where they start.

Do not include the abstract and the table of contents itself in the table of contents. The acknowledgements, if any, should follow the appendices and should be the last page of the report. Every page of the report other than the title page and abstract should be numbered. Pages of Table of Contents, Nomenclature, List of Tables and List of Figures should be numbered with lower case Roman numerals (i, ii, iii, iv, ...etc.). From the first page of the first chapter onwards, all the pages should be numbered using Hindu-Arabic numerals (1, 2, 3, ... etc.).

**4. The Chapters.** The number of chapters you need and their contents strongly depend on the topic selected and the subject matter to be presented. Roughly the following chapters may be included.

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However, it is your own report and you have to structure it according to the flow of overall logic and organization.

Introduction. In this chapter you formulate the problem that you want to address, the initial goals you had, etc. without going into details. Here you also describe the structure of the rest of your report, indicating which chapter will address which issue.

Literature Survey. The discussion on the literature may be organized under a separate chapter & titled suitably. Summarize the literature that you have read. Rather than literally copying the texts that you have read, you should present your own interpretation of the theory. This will help you in developing your own thinking discipline and technical language.

Theory-Oriented Chapters. The basic theory necessary to formulate the subject matter may be presented under a separate chapter & titled suitably.

Practice-Oriented Chapters. Depending on the work that you have done, it might be important to write about the system specifications, practical details, system behaviour and characteristics and cross links of the selected topic.

Conclusions. This is one of the most important chapters and should be carefully written. Here you evaluate your study, state which of the initial goals were reached and which not, mention the strong and weak points of your work, etc. You may point out the issues recommended for future research.

Each chapter, section, subsection, etc. should have a title. An identical entry should exist in the TOC.

Each chapter is numbered using Hindu-Arabic numerals: 1, 2, 3, ...

Sections within a chapter are numbered using a two-level scheme, (chapter no).(section no); for example, sections in chapter 3 are numbered 3.1, 3.2, 3.3, ...

Subsections within a section are numbered using a three-level scheme, (chapter no).(section no).(subsection no); for example, subsections in chapter 3, section 2 are numbered 3.2.1, 3.2.2, 3.2.3, ...

Generally, there should not be a need for sub-subsections !

**5. Equations.** Each equation should be numbered using a two-level scheme, (chapter no).(eq no). While typing, the equation numbers should be flush right. (LaTeX does this by default.) This number (e.g. Eqn.2.4, with 2 as chapter number and 4 as equation number) should be used whenever the equation is referred in the text. The equations should be clearly written. Symbols used in the equations should be explained immediately after the equation when they are referred first as well as in the nomenclature. SI units must be used through out the report. Example:

$$a = b + c \quad (3.14)$$

**6. Acronyms.** Avoid acronyms (short forms) in the report except the following standard ones. Equation(s) : Eq(s), Figure(s) : Fig(s). The words 'Table' and 'Chapter' are not shortened. If any other acronyms have to be used, list them separately at the beginning (after nomenclature). Mention the

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acronym in the brackets following its full form, whenever it occurs first. **The first word in a sentence is never a short form.**

**7. Tables and figures.** Tables and figures should be numbered and captioned. Each table or figure should be numbered using a two-level scheme, (chapter no).(table no) or (chapter no).(figure no). This number (e.g. Table 4.8, or Fig. 3.7) should be used whenever the equation is referred in the text. Each table as well as figure should have a title. An identical entry should exist in List of Tables or List of Figures respectively. Title of a table is given at the top of the table following its number. Title of a figure is given at the bottom of the figure following its number. Tables and figures should be on separate pages immediately following the page where they are referred first. Photocopied tables should not be included. Photocopied figures should be avoided as far as possible and if included they should be large enough and clear. If taken from any reference, the reference should be cited within the text as well as at the caption of the figure or table.

**8. References.** Each entry in the reference has a label. Any reference from the main text to the entry should use this label. All references cited in the text-body should be there in the Reference list and all entries in the Reference list should be there in the text-body. Established acronyms may be used. E.g. AC, DC, ASME, ASTM, IIT, Jnl, etc., provided there is no likelihood of any confusion.

Labeling. One of the following systems can be used for labeling the cited entries.

System 1 : A numeric label arranged in a order of citation in the main text. This label is used in square brackets at the point of citation. The references should be arranged together in the order of this numeric label.

System 2: A label derived from the authors name and the year of publication. For entries with 2 authors, include the surnames of both the authors followed by the year of publication. For entries with multiple authors, include the surnames of the first author followed by 'et al.' and the year of publication. This label is used in round brackets at the point of citation. The references should be arranged together in the alphabetical order of the authors surname (1<sup>st</sup> priority) and the year of publication (2<sup>nd</sup> priority).

Details of entries. The reference list thus compiled together should be included after the main text but before the Appendices, if any. In the reference list, you should provide the details of each entry in the following manner. These details differ depending on the type of bibliographic entry. Note the *italics*.

- 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.

Bandyopadhyay S., Bera N.C. and Bhattacharyya S., 'Thermoeconomic Optimization of Combined Cycle Power Plants', *Energy Conver. Mgmt.*, **42**(3), 359-371, 2001.

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

Kedare S.B. 'Optics, Design, Performance and Economics of the Dynamic Fresnel Paraboloid Reflector Concentrator Dish with Point Focus for High Temperature Solar Thermal Applications', *Proceedings of National Renewable Energy Convention '99*, Sawhney R.L. (Ed.), 9-15, 1999.

Dhole V.R. and Buckingham P.R., 'Refinery Column Integration for De-Bottlenecking and Energy Savings', Presented at *ESCAPE IV*, Dublin, Mar 1994

- **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.

Bilgen E., Industrial Solar Power Stations, Veziroglu T.N. (Ed.), *Solar Energy and Conservation: Technology, Commercialization, Utilization*, Volume2, 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>, Aug 16, 2002

**Bibliography.** In a few exceptional cases, it is useful to suggest a list of publications for background reading. These are not cited anywhere in the text. This list can be included as 'Bibliography'. It should follow 'References' on a fresh page.

**9. The Appendices.** Appendices are useful for those things that you consider important, but that do not fit in the main presentation of your work. There could be several reasons for using appendices: the material is too long and has too many details (e.g. the specifications of instruments or equipment), you

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have formulated a theorem, the proof of which is too long for the main text, you want to include a user manual for the software that you have come across (strongly recommended!), you want to present the schematics of a hardware design, experimental set-up, etc. Appendices tend to occupy many pages. Think carefully on what you want to include. For example, complete listings of the source code that you have written are seldom interesting. Instead, add a flow chart. Avoid describing the test set-up where a schematic can be easily used.

Appendices follow chapters, and are numbered using Roman numerals. Thus, Appendix I, Appendix II, Appendix III, etc. These days, 'numbering' of appendices using capital English letters may also be acceptable, e.g. Appendix A, Appendix B, Appendix C, etc. If you have just one appendix, then it is not numbered !

### **Appendix : Alphabetical order of Greek letters**

Alpha beta gamma delta epsilon zeta eta theta iota kappa lambda mu nu xi omicron pi rho sigma tau upsilon phi chi psi omega