GUIDELINES FOR THE PREPARATION OF ME4 PROJECT REPORT

1. Length of the thesis:

   The body of the thesis, which consists of the Introduction, Experimental Procedures, Results, Discussion, Conclusion, Recommendation and diagrams (if included) shall be normally THIRTY (30) A4 pages, typewritten and double spaced. Supervisors' permission should be obtained to increase the number of pages up to a maximum of 50. Additional materials like figures, tables, computer programs, etc., may be included in the appendices.

2. The report should be written in English in the third person. The Standard International System of Units (SI) should be used.

3. White, A4 size bond paper of at least 80 gms should be used.

4. The report is to be printed on both sides of the paper and double spaced unless indicated otherwise by your supervisor/s. The minimum size of the letter should be 12 point.

5. A margin of about 4 cm on the left hand side must be provided. At the top, bottom and the right hand side, a margin of 3 cm is recommended.

6. Report format:

   - Title Page
   - Summary (not exceeding two pages)
   - Acknowledgement
   - Table of Contents
   - List of Figures
   - List of Tables
   - List of Symbols
   - Introduction
   - Literature Survey (or Historical background)
   - The main text (the text should be divided into different sections with a heading for each section)
   - Results and Discussion
   - Conclusions
   - Recommendations for Further Work
   - References
   - Appendices

   A brief description of different elements of the report is included in appendix 1.

7. All figures and tables should be numbered. Figure number and caption should appear below the figure whereas for the table, the number and the caption should appear at the top of the table, as shown in the following example.

<u>Table 1: Convective Heat Transfer Coefficient</u>

Materials of spheres	Reynolds Number	Convective heat transfer coefficient, W/m^{2}k		% Difference between Expt. & Empirical results
		Experimental	Empirical eqn. (4)	
Aluminium	36 758	96.4	72.14	26.3
Brass	37 590	106.9	73.22	31.5
Mild Steel	36 689	94.6	72.32	23.4

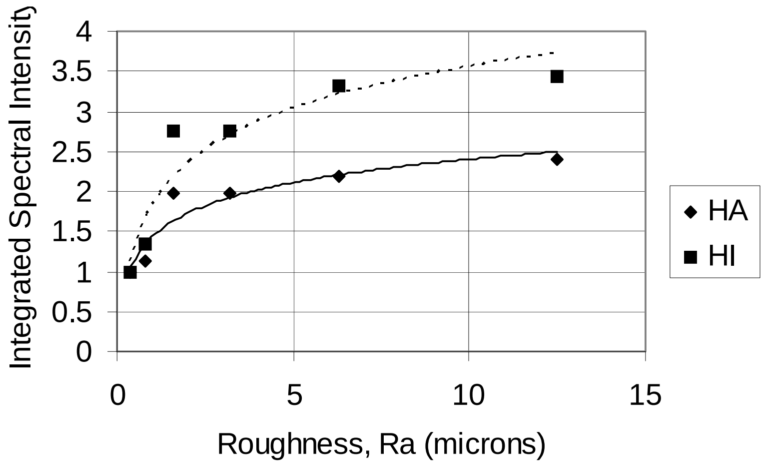

Fig. 1: Graph of Spectral Intensity Vs Roughness

8. For final submission, all copies of the report should be bound with a black hard cover. Softcopies should be stored in CD-R. One hard and soft copy should be submitted to each of your SUPERVISOR/S, and one soft copy to your respective Academic Group Labs.

   The front cover should include the title of the report, name of the student, department and session, as shown below.

....   (Title of project)   ....   (Name of student)   Department of Mechanical Engineering   National University of Singapore   Session 2007/2008

Appendix I

DESCRIPTION OF THE DIFFERENT ELEMENTS OF A FORMAL REPORT

A brief description of different elements of a formal report is included in the following pages.

Title Page

The title page includes the following information:

(a) title and sub-title;
(b) author's name;
(c) name of the organization and division responsible for the report;
(d) date.

Figure 1 shows a typical title page of a final year project report.

Summary

The summary should be an informative précis of the entire work and functions as an independent unit, a mini-report. It represents the entire report and allows the busy reader to understand the report's significant information without going any further. Usually, the summary includes statements of (a) purpose and problem of the report, (b) the important facts on which the conclusions are founded, (c) the conclusions, and (d) the recommendations. In the example, Figure 2, the first two paragraphs give a brief introduction of the report, paragraphs three and four summarize the methods, results and significance, and the last two paragraphs briefly describe the conclusions and recommendations.

Acknowledgement

Assistance In the preparation of the report or in carrying out the reported work should be fully acknowledged in this section as shown in Figure 3. It is not usual to acknowledge minor assistance or general advice and as such discretion should be exercised in deciding what merits acknowledgements.

Table of Contents

A table of contents, Figure 4, tells the reader what the report contains and where to find it. A table of contents is required for all but the very shortest of reports.

To assist the reader, it is necessary to maintain uniformity between items in the table of contents and headings in the report. If, in the table of contents, the first- and second-level headings are in capital letters, and third level headings are underlined, the reader should find exactly the same words and typographical devices in the headings of the report.

List of Figures and Tables

Illustrations include both tables and figures. Usually, it appears throughout the body of the report as well as in the appendix. Figures 5 and 6 show the illustration of List of Figures and Tables respectively.

List of Symbols

Symbols and abbreviations should be defined where it first appeared in the text. When these symbols and abbreviations are numerous, a separate list should be included with definitions. Symbols and abbreviations should comply with the accepted international standards, and arranged in the alphabetical order separating the Roman scripts from Greek scripts. Figure 7 shows a list of symbols and abbreviations.

Next, we will consider the body of the report which generally includes introduction, methodology, results, discussions, and recommendation, preferably in that order.

Introduction

Every report shall have an introduction section and it prepares the reader to understand the body of the report. An introduction should include PURPOSE, PROBLEM AND SCOPE without necessarily using them as a heading.

Purpose (or objective) Statement

The first portion of an introduction, the purpose statement, can be expressed in one or two sentences.

The Problem

Once the purpose or objective of the exercise is identified, it leads one into the second part of introduction i.e. the definition of the problem. It is very essential that the readers be completely informed about the problem before being told of its solution. To supplement the definition for complex problem, it may require background information which may be included in a separate section as literature survey.

Scope

A statement of scope reveals the emphasis, boundary, and organisation of a report. It identifies the main sections of the report. By listing the sections in the order they appear in the body of the report, one also indicates the report's organization.

Main Text

This includes theory, experiment, results and discussion.

Theory

In some cases, the report may be primarily of a theoretical nature rather than experimental. In those cases, theory should be substituted for experimental procedure and results. Where results include detailed theoretical treatment in addition to the experimental work, theory shall precede experimental procedure and results. Established theory should not be included in the main text, but if required should be given as an Appendix.

Experimental Work

This section deals with the manner in which the work was carried out and the results obtained. Here, emphasis should be given to anything new; only very brief description of standard apparatus and technique should be included. If more details of the experimental aspects are intended to be included, this should be presented in an appendix.

Normally, the details should be just sufficient to enable an adequately skilled worker in the field to retrace the steps of the investigation without much difficulty.

Usually this section will consist of a number of subsections for easy understanding of the subject matter. The results of the experiment should form the ultimate subsection.

Results and Discussion

The discussion deals with the interpretation of the results and the reasoning on which the conclusions are founded. It may be possible to shed light on the work in terms of new or extended principles or theories in the field covered. Although it may be difficult to separate the discussion from the preceding experimental procedure and results, whenever possible a separate section should be included. Attempt should be made to discuss and compare the results with those obtained by other researchers.

Conclusions

The conclusions represent a distinct and orderly presentation of deductions made after full consideration of the results of the exercise. Inclusion of quantitative information is not inappropriate but the details of an involved argument or result should not be included. Brief, numbered conclusions, limited to information having the greatest impact are the most effective.

Recommendations for Further Work

Recommendations are brief statements of further action considered necessary as a result of the conclusions reached. It arises from the conclusion and should be fully justified by the study included in the report.

List of References

A list of bibliographical references should be provided when the report contains information from other sources and should be numbered in the manner in which they appear in the text. Literature references in the text should be cited by numerals on the line in square brackets, thus [1], Figure 8 shows a typical list of references.

Appendices

Usually, the appendices include detailed explanation of methods and techniques summarized in the main text together with the supplementary matter which would not be appropriate to include in the main body of the text. Nowadays, the trend is towards greater use of appendices to shorten the main report. Figures 9, 10 and 11 are examples of an appendix.

(PROJECT TITLE)

Submitted by
(Student Name)

Department of
Mechanical Engineering

In partial fulfilment of the
requirements for the Degree of
Bachelor of Engineering
National University of Singapore

Session 2007/2008

Fig. 1: A title page for a final year project report

SUMMARY

In this experiment, the convective heat transfer coefficients for spheres of different materials were determined by cooling it from a higher temperature by blowing air over it.

It is necessary to determine heat transfer coefficient in order to evaluate the cooling rate of spheres of different materials, when subjected to heat treatment.

The transient heat transfer mechanism within the sphere is usually multi-dimensional in nature and the analysis of the problem is quite involved. A lumped heat-capacity type of analysis has been employed to evaluate the heat transfer coefficient. This analysis considers the body resistance to heat transfer negligible compared to the surface resistance.

Three metal spheres of different materials, aluminium, brass and mild steel, were heated over long period in a constant temperature oven in order to ensure uniform temperature distribution within the body of the spheres. Each of these spheres was mounted in the wind tunnel where air was blown at constant speed. The cooling rate was determined by recording the temperature at the centre of the spheres.

For the Reynolds number considered in this experiment, the convective heat transfer coefficients were found to be 97.9, 106.9 and 94.6 W/m^2 for aluminium, brass and mild steel spheres respectively.

To determine cooling rate of spheres having Biot number less than 0.1, the convective heat transfer coefficients may be used as above for Reynolds number of about 36,000. If needed, further experiments should be carried out to evaluate heat transfer coefficients at Reynolds number other than 36,000.

(i)

Fig. 2: Summary

ACKNOWLEDGEMENT

The author wishes to express sincere appreciation of the assistance given by the Supervisor of the experiment and the technicians of the Heat Transfer Laboratory in carrying out the work successfully.

(ii)

Fig. 3: Acknowledgement

TABLE OF CONTENTS

(iii)

Fig. 4: Table of Contents

LIST OF FIGURES

(iv)

Fig. 5: List of Figures

LIST OF TABLES

(v)

Fig. 6: List of Tables

LIST OF SYMBOLS

A_s surface area of the sphere, m^2

B_i Biot Number - hL_c /k

C specific heat, kJ/kg.k

C_a specific heat of air, kJ/kg.k

F_o Fourier Number - $\frac{\alpha t}{Lc^2}$

h average convective heat transfer coefficient, kW/m^2 k

k thermal conductivity of material, kW/m.k

k_a thermal conductivity of air

L_c characteristic length

Nu Nusselt number - hd/ka

Pr Prandtl number - $\mu C_a /k_a$

q rate of heat dissipation from the surface of the sphere, kW

R_e Reynolds number - $U\rho a/d$

r_o radius of sphere, m

T temperature of the sphere at time, t, °K

T_i temperature of the sphere at time, t = 0, °K

T_∞ ambient temperature, °K

t time, sec

U velocity of air, m/s

V volume of the sphere, m^3

α thermal diffusivity, m^2/s , = $k/\rho c$

μ viscosity of air, kg/m.s

ρ density of the sphere, kg/m^3

ρ_a density of air. kg/m^3

(iv)

Fig. 7: List of symbols

REFERENCES

1. Pippard, A. J. S., and Baker, J., “The Analysis of Engineering Structures," McGraw-Hill Book Co., New York, 1968, pp. 521 -524.

2. Grieve, R. J., and Rubinson, C. K., “An Experimental Investigation of the Dynamic Cutting of Steel," Int. J. Machine Tool Design and Research, 1973, Vol. 13, No. 6, pp. 21 27.

3 . Chin, C. H., and Lim, T. H., “Computer Application for the Analysis of Multi-Storey Buildings," M. Eng. Thesis, University of Singapore, Singapore, 1973, pp. 15 - 18.

4. Beckman, W. A. and Klein, S. A., “Solar Heating Design by f-chart Method," Proc. International Solar Energy Soc. Congress, Brighton, U. K., 1980, pp. 113 - 120.

Fig. 8: References

APPENDICES

Appendix 1: Derivation of fringe visibility of nonlinear photographic recording V_N

In practice, nonlinearity effects are introduced by overexposing the photographic film, so that the relation between the amplitude transmittance T of the film and the light intensity contains higher order polynomials [5,6], i.e.

$$T = \alpha - \beta t I + \gamma t^2 I^2 \qquad (10)$$

where γ is another film constant.

Equation 3 then becomes

$$I_t = I' [\, \alpha - \beta t I + \gamma t^2 I^2 \,] \qquad (11)$$

Substituting eq. 11 into eq. 6,

$$I_{av} = \frac{1}{2}\int_0^{2\pi} I' \alpha \, d\Phi - \frac{1}{2}\int_0^{2\pi} \beta t I' I \, d\Phi + \frac{1}{2}\int_0^{2\pi} \gamma t^2 I' I^2 \, d\Phi \qquad (12)$$

Substituting eqs. 1 & 2 into eq. 12 and integrating,

$$I_{av} = C_3 - C_4 \cos\Delta \qquad (13)$$

where $C_3 = 2a^2\alpha - 4a^4\beta t + 12a^6\gamma t^2 = C_1 + 12a^6\gamma t^2$

and $C_4 = 2a^4\beta t - 8a^6\gamma t^2 = C_2 - 8a^6\gamma t^2$

Equation 13 represents the same fringe characteristics as eq. 8 with bright fringes occurring at $\Delta = (2n + 1)\pi$ and dark fringes at $\Delta = 2n\pi$ for n = 0, 1, 2 ...... The fringe visibility of nonlinear photographic recording V_N from eq. 9 is thus :

$$V_N = \frac{C_4}{C_3} = \frac{C_2 - 8a^6\gamma\, t^2}{C_1 + 12a^6\gamma\, t^2} < \frac{C_2}{C_1}$$

Fig. 9: Example of an appendix

Appendix 2

Table 1: Cooling data

Material of the sphere: Aluminium Speed Controller Position: 60 FSD of chart recorder: 10 mV			Chart Recorder Speed: l cm/min Manometer Reading: 13.8 mm H_2O Room Temperature: 27.5°C		
Time (mins)	Thermocouple readings (mV)	Temperature (°C)	$\frac{T-T_\infty}{T_i-T_\infty}$	$ln\frac{T-T_\infty}{T_i-T_\infty}$	$\alpha t / r_0^2$
0	5.95	135	1	0	0
1	4.35	100	0.674	-0.394	8.08
2	3.55	82	0.507	-0.679	16.16
3	2.90	68	0.377	-0.976	24.24
4	2.45	58	0.284	-1.259	32.33
5	2.15	50	0.209	-1.565	40.41
6	1.90	46	0.172	-1.760	48.49
7	1.70	40	0.116	-2.154	56.57
8	1.55	38	0.098	-2.323	64.65
9	1.45	36	0.079	-2.538	72.73
l0	1.40	34	0.061	-2.797	80.81
11	1.32	32	0.042	-3.170	88.89
12	1.30	30	0.023	-3.772	96.98
13	1.25	29	0.014	-4.269	106.06
14	1.23	28	4.65×10^{-3}	-5.370	113.14
15	1.20	28	4.65×10^{-3}	-5.370	121.22
16	1.20	28	4.65×10^{-3}	-5.370	129.30

Fig. 10: Example of an appendix

Appendix 3

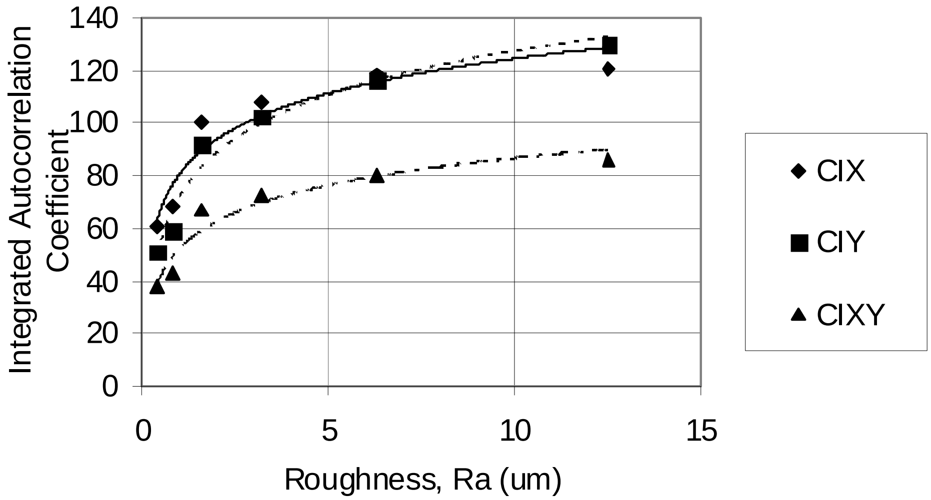

Figure 3.1: Graph of Integrated Autocorrelation Coefficient Vs Roughness

Fig. 11: Example of an appendix