<This page shows the required format for the title page of your report. Please stick strictly to the font sizes and placement of the text. Your individual Project Report Number must be included on this page as shown below. Delete only the text on these lines (and where instructions on formatting appear within < >). Preserve the lines>

RESEARCH PROJECT IN MECHANICAL <or MECHATRONICS> ENGINEERING

<14 pt, all caps, bold, centred>

TITLE OF YOUR REPORT HERE
<12 pt, all caps, bold, centred, within box, over 1-3 lines>

Richard J. T. Lin <14 pt>

Project Report ME000-2017 or MT000-2017 <12 pt>

Co-worker: Rajnish N. Sharma

Supervisor: Assoc. Prof. Krishnan Jayaraman
<12 pt>

Department of Mechanical Engineering
University of Auckland

06 March 2017
<12 pt>

<The frame is 105 mm wide by 50 mm high, and is positioned 57 mm from the left-hand edge of the paper, 72 mm from the top edge of the paper, and approximately 175 mm from the bottom edge. No page number>

<NOTE: this page in the handbook file may not exactly conform to these measurements>

INSTRUCTIONS AND ADVICE RELATING TO RESEARCH PROJECT IN MECHANICAL <or MECHATRONICS> ENGINEERING

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R. J. T. LIN

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ABSTRACT

The Part IV Research Project in Mechanical and Mechatronics Engineering provides an opportunity for students to work under supervision, largely on their own initiative, on some topic of interest in Mechanical Engineering or Mechatronics. It counts as two papers, one in each of the two semesters, and the project work takes place over a complete academic year.

The aims of the project are to undertake problem formulation, management and solution; to acquire technical, personal and professional competencies; and to learn and practice communication skills.

The project is made up of an electronically submitted project report of no more than 20 pages (worth 50% of the final grade); a literature review report (5%); a mid-year progress report (10%); a formal seminar presentation of 20 minutes per project group (10%); a display for invited judges from industry (10%); and on-course assessment by the supervisor for each semester (7.5% each, total 15%). To be able to complete the project work, each student must demonstrate that he or she has satisfactorily completed appropriate risk assessment(s), and which must be reported upon within the mid-year and final reports. To pass the projects course, it is mandatory for the student to obtain a pass grade for the final report, in addition to obtaining an overall pass grade.

Students are also required to submit in March a project information sheet, a safety sheet, and a specification for the project in the form of an abstract and planning schedule. The safety sheet submission and completion of a risk assessment are required to get permission to work in the laboratories; the specification is necessary to plan the work.

This handbook gives all necessary details for the project and its various components.

< The word “ABSTRACT” should be centred in 14 pt bold upper case, while the content of the abstract section must be in 12 pt. The abstract text should be indented 10 mm from the left and right margins. The abstract should be no longer than 250 words; it must summarise the objectives, results and conclusions of your project. >

DECLARATION

Student

I …….. hereby declare that:

1. This report is the result of the final year project work carried out by my project partner (see cover page) and I under the guidance of our supervisor (see cover page) in the 2017 academic year at the Department of Mechanical Engineering, Faculty of Engineering, University of Auckland.
2. This report is not the outcome of work done previously.
3. This report is not the outcome of work done in collaboration, except that with a project sponsor as stated in the text.
4. This report is not the same as any report, thesis, conference article or journal paper, or any other publication or unpublished work in any format.

In the case of a continuing project: State clearly what has been developed during the project and what was available from previous year(s):

Signature: _____

Date: _____

Supervisor

I confirm that the project work undertaken by this student in the 2017 academic year **is / is not** (*strikethrough as appropriate*) part of a continuing project, components of which have been completed previously.

Comments, if any:

Signature: _____

Date: _____

Table of Contents

<< References > Table of Contents > Automatic Table 1 >>

ABSTRACT ..... **ii**

DECLARATION ..... **iii**

Acknowledgements ..... **vi**

Glossary of Terms ..... **vii**

Abbreviations ..... **vii**

Nomenclature ..... **vii**

Schedule of Critical Dates: Deliverables, Events, Seminars (PLANNER) ..... **viii**

1 Nature, Scope and Aims of the Final Year Project **1**

2 Project Registration **2**

3 Formal Requirements of Paper MECHENG 700A&B **2**

4 Seminars and Lectures **3**

5 Deliverables, Submission Dates and Procedure, and Assessment **4**

6 Project Work: General **5**

6.1 Time management, supervision, and record keeping 5
6.1.1 Time management and supervision *5*
6.1.2 Record keeping *5*
6.2 Experimental work 5
6.3 Laboratory access, safety, technical assistance, manufacturing, and purchasing 6
6.4 Computer simulation tools and resources 7
6.5 Intellectual property (IP) 8
6.6 Project administration and communication 8

7 Elements of Semester 1 Work **9**

7.1 Safety Induction Form, Project Information Sheet, and Risk Assessment 9
7.2 Abstract and planning schedule 9
7.3 Literature review report 10
7.4 Mid-year progress report 11

8 Final Report **12**

8.1 General information 12
8.1.1 Individuality of the report *12*
8.1.2 Assessment of report *12*
8.1.3 Submission deadline *12*
8.1.4 Notes on plagiarism *13*
8.1.5 Past years project reports *13*
8.2 Online submission of the final report (one per student) 13
8.4 Format of the report 13
8.5 Structure of the report 14
8.6 Presentation and style 16
8.7 Length 16
8.8 The process of writing the report: suggestions 16
8.9 Feedback on your report 17
8.10 Large amounts of raw data 17
8.11 Confidentiality issues 17
8.12 Subsequent publication 17

9 Project Conference **17**

9.1 Mid-year practice presentations (MYPP) 18
9.2 Project conference 18
9.3 Assessment of the conference presentation 19

10 Displays Day and Award Function Evening 19

10.1 General guidelines for the display 19
10.2 Formatting and submission of the display poster 20
10.3 Project function and prizes 20

11 Project Completion Checklist 21

Appendix A Formatting Instructions for the Final Project Report 22

A.1 Font, spacing, margins, justification, page numbering, report length 22
A.2 Headings 22
A.3 Use of references 23
A.4 Use of SI units 23
A.5 Abbreviations 23
A.6 Mathematical symbols and equations 23
A.7 Illustrations: guidelines 24
A.7.1 Illustrations and captions in the main body of report. 24
A.7.2 Captions in the appendices 25

Appendix B Criteria for the Assessment of the Final Project Report 26

Appendix C Guidelines on Referencing 27

C.1 University of Auckland Engineering (numbered) style 27
C.1.1 Example: Numbered system of referencing for final year projects – Text and corresponding List of References © Heather Silyn-Roberts, 2012. 27
C.1.2 Referencing conference papers using University of Auckland Engineering (numbered) style 28
C.2 Harvard referencing style 29
C.2.1 Example: Harvard system of referencing for the text and reference list in C.1.1. 29
C.2.2 Referencing conference papers using Harvard style 30
C.3 How to reference problematic sources 31

Appendix D Assessment of Mid-year and Conference Presentations 33

Appendix E Advice about Project Display Day 34

Acknowledgements

The Final Year Projects (FYP) Courses, the manner in which these are run, and the FYP Handbook which also serves as a report template, have evolved over many years with input from many academic staff and others, current and former, within the Department of Mechanical Engineering. Their contributions are gratefully acknowledged.

FYP 2017 Committee:

- Richard Lin (*Projects coordinator/course director*)
- Jonathan Stringer (*Safety and Risk Assessment coordinator*)
- Michael Kingan (*Conference coordinator*)
- Richard Flay (*Displays judging coordinator*)
- Krishnan Jayaraman (*HOD*)
- Peter Richards (*Deputy HOD (Academic), Mechanical*)
- Kean Aw (*Deputy HOD (Research)*)
- Rajnish N Sharma (*Thermofluids*)
- Xun Xu (*Manufacturing systems*)
- Jaspreet Dhupia (*Dynamics and control*)
- Brian Mace (*Mechatronics*)
- Simon Bickerton (*Strength of materials/CACM*)
- Hazim Namik (*Project documentation*)

Former final year projects coordinators/directors:

- Rajnish N Sharma
- Heather Silyn-Roberts
- Krishnan Jayaraman
- Robert Raine
- Peter Richards
- Debes Bhattacharyya
- Peter Jackson

Glossary of Terms

Bird's-Eye View	Shows a land or picture from directly overhead at a very interesting angle. Usually to emphasise the vastness of an area.
Deadline	The latest time or date by which something should be completed.
Deadline	A line drawn around a prison beyond which prisoners were liable to be shot.
Effective area	The 'shadow' of the parachute that is seen by the wind to allow it to slow the system down.

Abbreviations

AOA	Angle of attack
CACM	Centre for Advanced Composite Materials
CFD	Computational fluid dynamics
FoE	Faculty of Engineering
FYP	Final year projects

Nomenclature

Symbols

A	Area	m^2
A_o	Area of an opening in the wall	m^2
C_L	Coefficient of lift	---
D	Drag force	N
U	Flow speed	m/s

Greek Symbols

α	Angle of attack	°
δ	Boundary layer thickness	m
ν	Kinematic viscosity	m^2/s

Schedule of Critical Dates: Deliverables, Events, Seminars (PLANNER)

SEM1 (1173) Lectures: 3 pm MONDAYS (Eng1439/401-439) and TUESDAYS (Eng1401/401-401)

Cal Wk	Sem Wk	Month	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
11	1	MARCH	6 Sem 1 begins Intro RL/BM/KS/KJ	7 LLS Lec EM	8	9	10 PREG Due	11
12	2		13 Safety Lec JG, JS, RL	14 RA Lec JS, RP, RL	15	16	17	18
13	3		20 MCP Lec XX+Tech Staff	21 LRW Lec RL	22 Lab Safety Inductions	23	24 PIS/PSS/ APS Due	25
14	4		27 STR Lec SN, TA	28 WPD-1 Lec HN	29	30	31	1 April
15	5	APRIL	3 PGS Info HOD,D-HOD-R	4 WPD-2 Lec HN	5	6	7	8
16	6		10	11	12	13	14 Good Friday	15
17			17 Easter Monday	18 Uni Holiday	19	20	21	22
18			24 Mid-sem break	25 ANZAC day	26	27	28	29
19	7	MAY	1 May LRR Due	2 MYPRW Lec RL	3	4	5	6
20	8		8 IP Lec DS	9 DOE Lec RL/(NK)	10	11	12	13
21	9		15	16 DPP Lec KA	17	18	19	20
22	10		22	23	24	25	26	27
23	11		29	30	31	1 June	2	3
24	12	JUNE	5 Queen's Birthday	6	7	8	9 Lectures end	10 Study break begins
25			12	13	14 Study break ends	15 Exams begin	16	17
26			19	20	21	22	23	24
27			26	27	28	29	30	1 July
28		JULY	3 Exams end Semester 1 ends	4 Inter-semester break begins	5	6	7 Exam Mtg	8 Exam Mtg
29			10	11 MYPR Due	12	13	14	15
30			17	18	19	20	21	22 Inter-semester break ends

SEM2 (1175) Lectures: 2 pm TUESDAYS (Eng1439/401-439) { If required, 2 pm FRIDAYS (Eng1439/401-439)}

Cal Wk	Sem Wk	Month	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
31	1	JULY	24 Sem 2 begins	25 MYPP Lec RL	26	27	28	29
32	2	AUGUST	31	1 Aug MYPP	2 MYPP	3	4	5
33	3		7	8 MYPP	9 MYPP	10	11	12
34	4		14	15 PRW Lec MM	16	17	18	19
35	5		21	22	23	24	25	26
36	6		28	29	30	31	1 September	2
37		SEPTEMBER	4 Mid-sem break	5	6	7	8	9
38			11 Mid-sem break	12	13	14	15	16
39	7		18	19 Q/A Session RL	20	21	22	23
40	8		25	26 Spring Grad	27	28	29 FINAL REPORT Due	30
41	9	OCTOBER	2 Oct SYSTEMS WEEK	3 SYSTEMS WEEK	4 SYSTEMS WEEK	5 SYSTEMS WEEK	6 SYSTEMS WEEK	7
42	10		9	10 CPD+PCR Lec RF, MK, RL	11	12	13	14
43	11		16	17	18 POSTER Due	19	20	21 PROJECT CONFERENCE MK/RL
44	12		23 Labour day	24 PWU Ses'n RL	25	26 Displays, Dinner, Awards RF/RL	27 Lectures end	28 Study break begins
45			30	31 PCC Due	1 Nov Study break ends	2 Exams begin	3	4
46		NOVEMBER	6	7	8	9	10	11
47			13	14	15	16	17	18
48			20 Exams end	21	22	23	24 Ex Mtg	25

LECTURES / DELIVERABLES

APS	Abstract and planning schedule	PIS	Project information sheet	HOD	Head of Department
CPD	Conference presentation/displays	PREG	Project registration	JG	Jos Geurts (CACM)
DOE	Design of experiments	PRW	Project report write-up	JS	Jonathan Stringer
DPP	Data processing and presentation	PSS	Project safety sheet	KA	Kean Aw
IP	Intellectual property	PWU	Project wrap-up	KJ	Krishnan Jayaraman (HOD)
LLS	Library and literature search	RA	Risk assessment	KS	Karl Stol
LRR	Literature review report	STR	Simulation tools and resources	MK	Michael Kingan
LRW	Literature review write-up	WPD	Word processing and documenting	MM	Martin McCarthy
MCP	Manufacturing capabilities/ procedure	**STAFF / VISITING LECTURERS**		RF	Richard Flay
MYPP	Mid year project presentation	BM	Brian Mace	RL	Richard Lin
MYPRW	Mid year progress report write-up	D-HOD-R	Deputy HOD Research	RP	Rob Powell (HSW Manager)
PCC	Project completion checklist	DS	Duncan Schaut (*Baldwins*)	SN	Staurt Norris
PCP	Project conference presentation	EM	Emil Melnichenko (Library)	TA	Tom Allen
PGS	Post-graduate studies	HN	Hazim Namik	XX	Xun Xu

1 Nature, Scope and Aims of the Final Year Project

The Part IV Research Project in Mechanical and Mechatronics Engineering provides an opportunity for students to work under supervision, largely on their own initiative, on a topic of interest in Mechanical or Mechatronics Engineering.

The project can also be seen within a professional context where as an engineer, the student has to investigate a particular problem in some depth and produce both an analysis of the problem and its solution. For these, the student will need to draw upon a good level of knowledge and skills, both theoretical and practical, acquired in the degree programme, and extend these in many respects. The basis of the solution must include a formal report, a conference presentation, and an industrial display.

Some projects are primarily laboratory work; others involve a substantial liaison with local industry and yet others may be more analytical or computational. The topics offered are as wide as the interests of the members of staff in the Department, and may fall under one or more of the following areas: Acoustics, Aero/Fluid/Hydro Dynamics, Dynamics and Control, Industrial and Manufacturing Systems, Mechanics of Materials and Manufacturing Processes, Systems Engineering, Thermodynamics and Heat Transfer, and Mechatronics.

It may not be possible for every student to work on the project of his or her own first choice, but everyone should be able to find a topic in which they have a strong interest. Each project topic is assigned to a pair of students who work as a team. However, the following elements of the project are separately assessed: a literature review report, mid-year progress report, final report*****, conference presentation, and the quality of performance in the two semesters.

Individual grades are awarded for the project and a pass grade must be obtained for the final report, in addition to a passing overall grade, to pass the course.

The expected project work should occupy ten hours per week, including timetabled lecture(s) and a supervision hour, and extends from March through to early October.

The general aims of the Part IV research project may be summarised as follows:

- **To undertake problem formulation, management and solution**

  This will include detailed planning, problem formulation, scheduling the year's work, and completion to the various deadlines. In addition, one must take into account the availability of equipment, technician support, etc.

- **To acquire technical, personal and professional skills**

  This will involve self-discipline, specialised learning, attitude of a professional engineer, and working with others.

- **To learn and practice communication skills**

  This will include one’s relations with other people (supervisor, project partner and technical staff), and formal reporting (oral, written and display).

The performance of the student will be assessed on how well these aims have been achieved. It is hoped that students will feel a personal sense of achievement by the end of the project.

***** *NOTE: Past project reports may be accessed from the S-drive at:*
S:\student-share\PartIV-Project-Reports\MECH

2 Project Registration

Each project is undertaken by a pair of students. All students are therefore strongly encouraged to confirm project partners as early as possible. Student pairs are welcome to propose project topics of their own by the same deadline as the academic members to propose the projects (9/Feb/17). Each academic staff member is allowed to accept "one" ***student-initiated*** project as their pre-allocated project.

Once a project partner has been identified with the common areas of interest, upon notification, please get onto the departmental Part IV projects (P4P) webpage (https://apps.foe.auckland.ac.nz/p4p/) to see the full unallocated project list and follow the procedure to register your team preferences in the project (5) and discipline area (2) before the deadline (for 2017, it's 5 pm, Monday, 27/Feb). After that, allocation of the projects will be done according to your preferences by the Departmental Part IV project committee (DP4PC) which consists of the Part IV projects coordinator, the HoDs and the program leaders of mechanical and mechatronic engineering. The best effort will be put in to enable you to carry out the project of your top choice for FYP2017, but that is not guaranteed due to various reasons. The final allocation results will be made available just before or at the start of the semester 1 to ensure everyone can start the project from the first day of Semester 1, 2017. To complete the project registration, the students should confirm the projects with supervisors according to the published project allocation by the end of week 1, Semester 1. It should be noted that each academic staff member can only be allocated up to four projects nominally.

For those who do not have a partner and enter the preferences as a single person, you will be paired with a project partner during the allocation process done by the DP4PC. In the odd occasion, a single-person project could be allowed in each of the specialisations. The completion of project registration with the supervisor still needs to be done nonetheless after the allocation.

3 Formal Requirements of Paper MECHENG 700A&B

Students are expected to work consistently on their final year research project throughout the year, meet with their supervisors on a regular basis to discuss their progress and goals, and attend all the scheduled lectures, presentations and seminars. The supervisor awards project conduct marks to each student, in each of the two semesters. Students are required to satisfactorily complete risk assessment(s); submit a literature review report, a mid-year progress report and a final report; deliver a presentation; and provide a poster demonstration on their project on the displays day. Every student will be assessed in these components and must obtain a passing grade overall as well as for the final report, to pass the course.

There are strict timetable constraints, so no extensions will be possible for the reports, apart from extensions according to the standard Faculty of Engineering (FOE) processes for handling medical or compassionate situations affecting coursework. In such a case (a) the unfinished report would still need to be submitted by the deadline, and (b) a completed report then needs to be submitted at the earliest within any extension period specified in any University recognised medical or professional report or as determined by the head of department. The report would still be assessed according to the FOE processes as mentioned above and the department's standard assessment criteria. Late report submissions outside of these deadlines will incur severe penalties. The FOE processes will also apply to the conference presentation and display, in which case the corresponding assessment will be at the discretion of the head of department.

4 Seminars and Lectures

A number of lectures/seminars are scheduled in each of the two semesters, as in Table 1, that will cover various aspects of the conduct and management of the project. Some lectures will also cover the mechanics of report writing and conference presentation; while some others will be 'clinic' oriented to provide practical guidance on matters such as word processing and documentation, data processing, and preparation of presentations. A number of lectures will be used to communicate policies and procedures, and the tools and resources that are available for project work.

Students are expected to attend all the scheduled lectures, presentations and seminars.

Table 1 Final year project seminar/lecture schedule for 2017

SEMESTER 1: 3 pm Mondays (Eng1439/401-439) and Tuesdays (Eng1401/401-401)			
Week	Day	Topic	Staff
1	Monday (6/Mar)	Introduction	R Lin, K Stol, B Mace, K Jayaraman
	Tuesday (7/Mar)	Library and literature search [#]	Emil Melnichenko (*Library*)
2	Monday (13/Mar)	Safety	Jos Geurts, Jonathan Stringer
	Tuesday (14/Mar)	Risk Assessment	Rob Powell (*HSW*), Jonathan Stringer
3	Monday (20/Mar)	Manufacturing capabilities and procedure	Xun Xu, Technical Heads
	Tuesday (21/Mar)	Literature review and write-up	Richard Lin
4	Monday (27/Mar)	Simulation tools and resources	Stuart Norris, Kean Aw
	Tuesday (28/Mar)	Word processing / documentation (WPD-1)	Hazim Namik
5	Monday (3/Apr)	Postgraduate studies info session – Mech	HOD, Deputy HOD Research, and team
	Tuesday (4/Apr)	Word processing / documentation (WPD-2)	Hazim Namik
6	Monday (10/Apr)	---	---
	Tuesday (11/Apr)	---	---
7	Monday (1/May)	---	---
	Tuesday (2/May)	Mid-year progress report write-up	Richard Lin
8	Monday (8/May)	Intellectual property	Duncan Schaut (*Baldwins*)
	Tuesday (9/May)	Design of experiments	Richard Lin/Guest Lecturer
9	Monday (15/May)	---	---
	Tuesday (16/May)	Data processing and presentation	Kean Aw
10	Monday (22/May)	---	---
	Tuesday (23/May)	---	---
11	Monday (29/May)	---	---
	Tuesday (30/May)	---	---
12	Monday (5/Jun)	--- *Queen's Birthday* ---	---
	Tuesday (6/Jun)	---	---

SEMESTER 2: 2 pm, Tuesdays (Eng1439/401-439)			
Week	Day	Topic	Staff
1	Tuesday (25/Jul)	Mid-year practice presentation lecture	Richard Lin
2 ~ 3	Tuesday (1&8/Aug)	***Mid-year practice presentations (MYPP)***	All staff involved
	Wednesday (2&9/Aug)	***Mid-year practice presentations (MYPP)***	All staff involved
4	Tuesday (15/Aug)	Final report write-up	Martin McCarthy
5	Tuesday (22/Aug)	---	---
6	Tuesday (29/Aug)	---	---
7	Tuesday (19/Sep)	Question and answer session	Richard Lin
8	Tuesday (26/Sep)	--- *Spring Graduation* ---	---
9	Tuesday (3/Oct)	--- (*Systems engineering week*) ---	---
10	Tuesday (10/Oct)	Conference presentation, displays	Michael Kingan, Richard Flay, R. Lin
11	Tuesday (17/Oct)	---	---
12	Tuesday (24/Oct)	Project wrap-up session	Richard Lin

[#] *Details of library tutorials will be given. Procedure for booking into tutorials will be provided.*

5 Deliverables, Submission Dates and Procedure, and Assessment

Table 2 below summarises the key deliverables (or tasks) for the project, with submission or completion dates and procedure, comments on grading, weighting, and method of assessment.

Table 2 Project deliverables and key tasks

SEMESTER 1				
Deadline 2017	***Deliverable / Task***	***Submission / completion procedure***	***Marks/grade***	***Assessor(s)***
Fri 10 March (Week 1)	**Project registration**	*****1 per project pair. ***** Confirmed with the supervisor – online registration completed by supervisor. (See Sec 2)	None. Delayed registration will hinder start of project	
Fri 24 March (Week 3)	***Project safety sheet (PSS)** ***Project information sheet (PIS)**	*Hard copies submitted to technical staff in the assigned lab. *PSS: 1 per student *PIS: 1 per project pair	None. No lab work permitted until completed.	
Fri 24 March (Week 3) *5pm*	**Abstract and planning schedule**	*****1 per project pair. File name format: Supervisor-UPI1-UPI2-aps2017.pdf e.g. MaceB-jblo123-jdoe456-aps2017.pdf ***** Submission: Upload file to S-drive S:\MECH\Submit\MechEng700\APS\	Included in first semester's on-course assessment.	Supervisor
Mon 01 May (Week 7) *5pm*[#]	**Literature review report**	*****1 per student. File name format: Supervisor-UPI-lrr2017.pdf e.g. MaceB-jblo123-lrr2017.pdf ***** Submission: Upload file to S-drive S:\MECH\Submit\MechEng700\LRR\	5%	Supervisor
End of Sem 1	**First semester's work**	Attendance/Communication, Work ethics/Efforts; Quality of research; Progress of research; Team work; Etc. Details in Section 6.1	7.5% Graded	Supervisor
Tue 11 July (Inter-semester break) *5pm*[#]	**Mid-year progress report**	*****1 per student. File name format: ProjectNumber-2017-UPI-mypr.pdf e.g. ME056-2017-jdoe456-mypr.pdf ***** Submission: Upload file to S-drive S:\MECH\Submit\MechEng700\MYPR\	10% Graded	Supervisor

SEMESTER 2				
Deadline 2017	***Deliverable/Task***	***Submission / completion procedure***	***Marks/grade***	***Assessor(s)***
Tue 01 August to Wed 9 August (Weeks 2 and 3)	**Mid-year practice oral presentations**	Attend practice session as scheduled	None. Practice session	Supervisor considers in Sem 2 mark
Fri 29 September (Week 8) *5pm*[#]	**Final report** with appendices, submitted digitally as ONE file.	*****1 per student. File name format: ProjectNumber-2017-UPI-report.pdf e.g. ME056-2017-jdoe456-report.pdf ***** Submission: Upload file to S-drive S:\MECH\Submit\MechEng700\FinalReports\	50% Graded	2 academics 1 expert and 1 from other area.
Wed 18 October (Week 11) *5pm*[*]	**Poster submission**: * Digital file for printing by UoA;	** 1 per group.* File name format: ProjectNum-2017-UPI1-UPI2-poster.pdf e.g. ME056-2017-jblo123-jdoe456-poster.pdf * Submission: Upload file to S-drive *S:\MECH\Submit\MechEng700\Posters*		
Sat 21 October [Rm: TBA in OGGB] (Week 11)	**Project conference presentations**	*****Load Powerpoint presentation onto desktop before start of session *****Deliver as per instructions *****Attend any 4 sessions	10% Marked	2 members of dept. academic staff.
Thu 26 October [Poster: submitted in previous week] (Week 12)	**Project displays**. **Followed by project function & awards ceremony.**	*****Setup completed by 12 noon in allocated area, ready for judges. *****Tidy up after 5pm. *****Attend function from 6.30pm.	10% Marked	Judging panel from profession/ industry.
End of Sem 2	**Second semester's work**	Same as first semester's work. Details in Section 6.1	7.5% Graded	Supervisor
Tue 31 October (Study break) 5pm^	**Project completion checklist** (back of project information sheet)	*****Return / forward all things borrowed and all project related material. *****Sign off by technician and supervisor; ***** Submit to Mech. Office, L9, by 5pm	**^ Project will not be cleared for final grade** unless this signed form is submitted to Mech. office by this date and time.	

[#] *Reports submitted after 5pm will be severely penalised.*

** Late poster submission does not guarantee timely print and may print for display on own cost.*

6 Project Work: General

6.1 Time management, supervision, and record keeping

6.1.1 Time management and supervision

Since the project counts as 30 points, students are expected to dedicate on average at least 1 to 2 days per week (on average 10 hours per week), and to work steadily at it throughout the year. It is strongly advised that students allow a minimum of four hours per week in their personal timetable for project work in laboratories, library, etc.; three hours per week for reading, data processing, etc., during evenings and weekends; and an hour for meeting with supervisor.

It should be noted that the quality of the project work is the students' responsibility; the supervisor's role is to provide guidance. Where possible the students are advised to make maximum use of the supervisor's advice and expertise, regular meetings with the supervisor(s) need to be planned accordingly. Other staff members may be consulted as well when expertise in other areas is required.

6.1.2 Record keeping

Record keeping (in a journal book or electronically) is an important part of any research or engineering project. Whatever the nature of a project work, students should keep comprehensive notes and log data in a hard cover journal book (they may be transferred to the electronic form later if desired). Used properly, the records contain a detailed and permanent account of every step of the project, from the initial brainstorming to the final data analysis.

Many science and engineering projects require a number of steps and multiple trials. By recording the steps of the procedure, observations, and any questions that arise along the way, the project is properly documented, recording exactly what was done and when. With a complete record of the project, one can look back at the notes later if a question arises or if it is decided to pursue an alternative project idea based on something that was observed.

Similarly, writing down the product design ideas, engineering challenges, and testing data will help keep track of all of the ideas, what was already tried, and how well a particular idea or design performed.

Well documented records can result in good quality reports at the end of the project, especially when the project spans over several months, as in a final year undergraduate project. Meetings with supervisor(s) and others (your partner and/or any adviser) on the project should be minuted for later use. Loose sheets of paper are easily lost and are to be avoided. Tidied up meeting minutes (in electronic form) should be sent to the meeting attendees for their comments and keeping.

6.2 Experimental work

To obtain the maximum benefit from a series of experiments, they must be properly designed. How can the experimental program be designed to achieve the experimental objectives in the simplest manner with the minimum number of measurements and the least expense? A

successfully designed experimentation is a series of organized trials which enables one to obtain the most crucial information experimentally with the least amount of effort.

Once a hypothesis, context, and any theoretical models have been considered and the aims and objectives have been clearly identified, the experiments are designed so that it becomes clear (a) what variables are to be measured, (b) how are these to be measured – what tools and instruments will be required, and (c) what methods of data analysis will be employed. It is useful to produce a schematic diagram of the experimental setup. From this exercise, it will also be determined whether an existing test rig can be utilised or a new one will need to be designed and built.

Prior to performing the experiments, some important steps include setting up, testing of the rig and apparatus, calibration of instruments, and the conduct of preliminary experiments need to be carried out. There are no "correct" answers in laboratory work. It is inevitable that repeating an experiment under exactly the same conditions will almost certainly not lead to exactly the same result. Therefore, sensible conclusions can be drawn only if the accuracy of the results is known. This may be determined from an error analysis based on repeat experiments (at least five repeats are recommended!) and considering the stated or pre-determined accuracies of instruments used.

The full details on design of experiments will be discussed in a Week 8 lecture.

6.3 Laboratory access, safety, technical assistance, manufacturing, and purchasing

Experimental and design/build/test-based projects inevitably require the use of laboratories and physical workspaces with tools, instruments, and rigs. Depending on the academic area of the project, each student group/pair will be assigned to a laboratory. The student pair will work with the lead technician or the assigned technician for all their project work requirements from the laboratory or the workshops.

In these areas, safety is paramount and the students are responsible for their own safety as well as the safety of others through the safe use of the space, tools, and equipment that the students have been authorised to use.

Students are not permitted to enter the laboratories unless they:

- Have attended the safety lecture (Week 2)
- Are aware of all the safety requirements of the faculty, as discussed in the lecture, and outlined in the faculty Health and Safety Manual (a copy is available on Canvas) and at https://cdn.auckland.ac.nz/assets/central/about/the-university/how-the-university-works/policy-and-administration/Health%20and%20Safety/UOA%20Health%20and%20Safety%20Policy%20-%20Feb%202015.pdf.
- Are aware of all the safety requirements of the laboratory through a safety induction in the laboratory (Week 3), reading the safety brief for students (if any), and/or discussions with the technical staff.
- Have signed a *Mechanical Engineering Laboratory Safety Induction Form* provided in the course and forwarded it to the lead technician in their assigned laboratory (see section 7.1 for more information):
  - Jos Geurts – *CACM / MoM* j.geurts@auckland.ac.nz 9237251 Newmarket
  - Nick Velychko – *Aerodynamics* n.velychko@auckland.ac.nz 9239333 Newmarket
  - Alan Eaton – *Thermofluids* a.eaton@auckland.ac.nz 9237310 Newmarket
  - Hossein Hosseini – *Dynamics & Control* / *Mechatronics* / *Manufacturing Systems* s.hosseini@auckland.ac.nz 9235364 City

- Have completed a Risk Assessment Form and reviewed it with the project supervisor (see section 7.1 for more information).

For additional safety requirements, and bookings for specialist facilities, contact:

o Stephen Elder – *Engine and Fuels Testing Services* (EFTS)	st.elder@auckland.ac.nz	9238122	Newmarket
o Yin Fai Li – *Wind Tunnels*	fai.li@auckland.ac.nz	9232942	Newmarket

Other details and contacts will be located at: http://www.engineering.auckland.ac.nz/safety.

Students are not permitted to work in the laboratories:

- Without signing the appropriate declarations
- When they are just by themselves (i.e. alone) (must work at least in pairs or have others around in the lab)

When in doubt, the student should seek advice from the lead technician in the laboratory.

It should be noted that the project will not progress far without help from technical staff. Students will find the technicians much more willing to help if they are polite; if they know exactly what they want; if they do not pester them continually about minor things; and if they remember to keep the lab and workspaces tidy.

For the manufacture of test rigs and designs, each group is required to finalise their design in discussion with their supervisor to address academic requirements, and with the technician to address practicalities within the capabilities of the laboratory and workshop, and constraints of cost. It can be helpful to visit the manager of the Faculty Technical Services Workshop, now located at Newmarket Campus, with a technician, if possible, to obtain feedback before finalising a design. It should be noted that jobs can only be logged with the workshop by a technician (and not directly by the students), once it has been discussed with a technician and the supervisor – "No exceptions!"

During the course of the project, items may need to be purchased from outside of University. In the first instance, this must be approved by the supervisor, upon which the technician should be approached for the correct procedure. Usually a written quote must be obtained and the purchase request will be made by administrative or technical staff in the department via the University's Shared Transaction Centre. The whole process may take some time, so proper planning and time management are advised, especially if the item is required urgently. It should be noted that students are strongly discouraged from purchasing with their own funds – it is not only against procurement procedures, but furthermore, reimbursement is extremely difficult and very time consuming for a number of people involved.

To avoid disappointment, students are advised to have their designs finalised and in to the workshop as early as possible.

Further details will be provided during the lectures in Week 3 of Semester 1.

6.4 Computer simulation tools and resources

Some projects will require the use of computer simulation tools and resources, such as for solid dynamics or fluid flow modelling. Others may require simulation of electronic circuits and control systems. To this end, the department has licenses for and access to a range of simulation tools that project students will be welcome to use. Students should consult with their supervisors with regards the simulation tools best suited for their work, and for gaining access to them. Some of the tools available include:

- Ansys (FEA, CFX, etc) – finite element analysis, fluid flow, heat transfer modelling
- Creo, Mechanism toolbox – CAD, dynamic simulation, mechanisms, design, analysis
- Labview – for instrumentation, control, and so forth
- LTSpice – for electronic circuit simulation
- Matlab – for data processing, control, and modelling
- Simulink – to model control systems for real time targets

Most of the simulation work could be run on computers available in computer laboratories around the faculty. However, when the modelling and simulation work requires large computer resources because of the nature of the problem being solved (e.g. a full 3D multi-physics simulation of flow around an aircraft), then more powerful computing facilities may be needed. The students should consult with their supervisor with regards to this. If justifiable, then advanced computer cluster facilities may be made available on a case-by-case basis.

Further details will be provided during a lecture in Week 4 of Semester 1.

6.5 Intellectual property (IP)

The term 'intellectual property' (IP) refers to creations of the mind: inventions, literary and artistic works, and symbols, names, images and designs used in commerce. The University acknowledges that students may individually or jointly with their supervisors, create IP through project work.

As part of the enrolment process, the student will have agreed to abide by University policies that help to protect the rights of all of its members, including students, as well as those of the University itself. For full details, students should refer to the University of Auckland Intellectual Property Created by Staff and Students Policy, placed on Canvas, or found at https://cdn.auckland.ac.nz/assets/central/about/the-university/how-the-university-works/policy-and-administration/intellectual-property-created-by-staff-and-students-policy.pdf.

The students are referred to the supervisor or the Projects Coordinator(s) for guidance, if necessary.

Further details will be provided during a lecture in Week 8 of Semester 1.

6.6 Project administration and communication

Matters relating to the overall organisation and administration of projects are the responsibility of the Project Coordinator(s) and any question regarding such matters should be referred to them.

For matters relating to specific projects, students should deal directly with their supervisor(s).

The Project Coordinator(s) will make use of the following tools for project administration and communication: Weekly lectures and seminars from time to time; P4P Online Management System; Canvas; and Email.

The student may send an email to the Projects Coordinator(s) in the first instance for any query or question; or visit him in his office. If it is deemed necessary, during certain periods of the year, a consultation hour may be allocated in which the Coordinator may be visited in person.

STUDENTS ARE ADVISED TO READ THEIR EMAILS REGULARLY! It is very important to consistently read university emails, and more so over the last few weeks of the

project, i.e. the weeks spanning the report submission, presentations and displays. Last-minute changes and further advice will be made available this way.

7 Elements of Semester 1 Work

NOTE: A summary of deliverables and their submission procedures is given in section 5, page 4. Each of the elements in the year's work will be discussed in the project seminars.

The work during the year as assessed by the supervisor contributes 30% of the final grade. It will be assessed by the supervisor on the basis of the student's diligence, attendance at agreed meetings, progress, standard of experimental or modelling work, planning and organisation, co-operation with others and a mid-year report. 7.5% of this mark will be awarded at the end of the first semester, 5% for the literature review report, and 10% for the mid-year report.

7.1 Safety Induction Form, Project Information Sheet, and Risk Assessment

Each student must complete a *Mechanical Engineering Laboratory Safety Induction Form* for EACH lab space that they intend to use during the course of the project. This is to ensure each student is made aware of lab-specific safety precautions and emergency procedures.

Each group must complete a *Project Information Sheet* as well.

Access to lab spaces is restricted until the forms are completed and logged with the technician-in-charge of the lab.

Additionally, a *Risk Assessment Form* will need to be completed by each student to the satisfaction of the supervisor (and lead technician) before any project work can commence.

Copies of these sheets will be made available via weekly lecture, Canvas, or the laboratories. A student will not be permitted to start lab work until these are done.

Submission:

- *Safety Induction Form* (1 per student per lab space) and a *Project Information Sheet* (1 per group), logged with the technician-in-charge of the lab
- *Risk Assessment Form* (1 per student) should be submitted to the project supervisor. To ensure all students become familiar with the process of conducting risk assessments, on projects that do not require an assigned lab space (for example ones that are purely computational), the students will be required to complete a Risk Assessment Form on a sample project specified by the Supervisor.

The submission date can be found on pages viii and 4 of this handbook.

7.2 Abstract and planning schedule

Abstract: Each project group must write a specification for its project in the form of an abstract (1-page) and a planning schedule (1-page) in a single document file. This should be done in consultation with the supervisor; and the final draft should be approved first by the supervisor before submission. *The abstract page should also show the title of the project, both partners' names, and the supervisor's name*. A suggested format for the abstract (maximum 1-page) is as follows (this may vary):

- Paragraph 1 – Introduction to the subject/topic/area (brief)

- Paragraph 2 – What has been done, what needs to be done, and what problem is being addressed?
- Paragraph 3 – A statement of the aims and objectives of the research project
- Paragraph 4 – Indication of methodology to be used and resources required.

A Planning Schedule: A planning schedule, for example a Gantt chart, is to be submitted with the Abstract. There are many ways to create a Gantt chart. For example, Microsoft Project, which is a task-planning program, makes it easy to track and chart project timelines with a built-in Gantt chart view. Another option is to use Excel, by adapting the stacked bar chart.

Submission: The abstract and planning schedule (1 per project pair) should be submitted electronically as a single pdf file by 5 pm, Friday, 24/March.

- Filename format: SupervisorSurnameInitial-UPIStudent1-UPIStudent2-aps2017.pdf
  e.g. MaceB-jblo123-jdoe456-aps2017.pdf
- Submission: Upload to the S-drive folder:

  S:\MECH\Submit\MechEng700\APS\

The submission date can be found on pages viii and 4 of this handbook.

7.3 Literature review report

The purpose of the literature review is twofold:

1. To demonstrate that you are aware of the research relevant to your project, and
2. To summarise the important information or findings that will form the foundations of the work you are intending to carry out.

The review will also show that the research to be carried out in the project is something that has not been done before and is worth pursuing in order to advance the knowledge in the particular area. The review should show the breadth of the research area and some depth in particular areas.

Marking of the report will be done according to the following criteria:

- Structure of report
- Relevance to the research
- Conclusion from the review
- Quality of references
- Editorial/English/Grammar

The review is expected to be written in a cohesive style, not a paper-by-paper discussion.

The format, layout, presentation and style of this report should follow the guidelines given in this document. To summarise, this report must:

- *Not exceed 5 pages including figures but excluding the title page and reference list.*
- Follow the same formatting instructions as for the final report.

The literature review report would typically contain the following elements:

- A **title page** formatted exactly as the sample title page of this document.
- **Introduction**
- **Literature review**
- **Conclusions**
- **List of References**

Submission: The literature review report (1 per student) should be submitted electronically as a single pdf file by 5 pm, Monday, 01/May.

- Filename format: SupervisorSurnameInitial-UPI-lrr2017.pdf

  e.g. MaceB-jblo123-lrr2017.pdf
- Submission: Upload to the S-drive folder:

  S:\MECH\Submit\MechEng700\LRR\

The submission date can be found on pages viii and 4 of this handbook.

7.4 Mid-year progress report

IMPORTANT: As with the final report, each individual student's progress report must show that it has been written independently of his/her partner's. Each report will be submitted as a digital file to TurnItIn to check it against all others in the class and those of previous years.

The purpose of the mid-year progress report (1 per student) is to present an overview of the project, to report on progress to-date, and outline the work that remains to be completed. It is expected that as the nature of projects vary, so will the structure of reports. It is recommended that students consult their supervisors concerning the organisation and content of their report. Later on, the progress report together with feedback received will form the basis for the final report i.e. the progress report may be developed further into the final report.

The progress report is strictly limited to 10 pages (excluding title page and appendices), and its format should be similar to that of the final report (see Appendix A). It should include a concise introduction and background to the project, with clear statements of the aims and objectives. This will then be followed by a succinct literature review (can be refined from LRR) to demonstrate the students' understanding of the work already carried out by others on the topic, identifying the gaps in knowledge or important issues, and clarifying which aspects of these the research seeks to investigate. If a methodology has been established, or rigs have been designed, or (analytical, computational, or other) models have been developed, then these should also be discussed. The report ought to include a section on 'Progress to date' or 'Project status' in which the students' progress and the status of the project should be given. A reflective statement(s) should be included on the original goals and timeline, and a section on 'Work that remains to be completed' will need to be incorporated. The report should end with a conclusion section and a reference list.

The grading of the progress report will be done by the supervisor, and will largely be on the same basis as for the final report (see Appendix B).

The format, layout, presentation and style of this report should follow the guidelines given in this document. The fundamentals of writing a mid-year progress report will be covered in a lecture in Week 7 of Semester 1. To summarise, this report must:

- *Not exceed 10 pages including figures, excluding title page and reference list.*
- Follow the same formatting instructions as for the final report.

The mid-year progress report would typically contain the following elements:

- A **title page** formatted exactly as the sample title page of this document.
- A second page with an **abstract** of no more than 250 words formatted exactly as the sample second page of this document.
- **Introduction**
- **Literature review**

- **Middle sections** with appropriate section headings, including sections describing the work done and the work planned for the second semester (as discussed above!).
- **Conclusions**
- **List of References**

Submission: The individual mid-year progress report (also referred to as the interim report) is *to be submitted electronically* with a project number identifier (available on Canvas at the end of Semester 1), by 5 pm, Tuesday, 11/July (unless advised otherwise in Semester 1):

- Filename: ProjectNumber-2017-UPI-mypr.pdf

  e.g. ME004-2017-jblo123-mypr.pdf

- Submission: Upload to S-drive folder:

  S:\MECH\Submit\MechEng700\MYPR\

The submission date will be found on pages viii and 4 of this handbook.

8 Final Report

8.1 General information

8.1.1 Individuality of the report

An individual report is required from each student. Each individual student's final report must show that it has been written independently of his/her partner's. Each report (digital file) will be submitted to TurnItIn to check it against all others in the class and those of previous years.

8.1.2 Assessment of report

The report contributes 50% to each student's final grade based on marking by two examiners. Both of the examiners will be academic staff members of the Department of Mechanical Engineering (and/or project supervisor(s) from another department if there is any). Neither of these examiners will be the project supervisor. One examiner (the expert assessor) is a member of the academic staff in the research group to which the project belongs; the other is an academic staff member from another research group (the non-expert assessor). The criteria used to assess the reports are given in Appendix B.

8.1.3 Submission deadline

It is important to take note of the following with regards the **deadline** for report submission:

- The final report must be submitted online by 5:00 pm on the day of submission.
- The submission date will be found on pages viii and 4 of this handbook.
- Reports submitted after 5.00 pm will be severely penalised

  – 5 marks (10% of 50) off the examined report marks for late submission of every 24 hours. Since the final report needs to fetch a passing mark (25 out of 50), so if a report is submitted late by 5 days without any application of special consideration, the student will not be able to pass this course.

8.1.4 Notes on plagiarism

With regards the individual nature of the project report and **plagiarism** issues that could arise, the following should be noted:

- Each individual student's report must show that it has been written independently of his/her partners.
- A declaration has to be completed by all students, signed off by the student and supervisor as well, and to appear in the report stating clearly what has been developed during the project and what was available from previous years.
- If the examiners judge that the text and/or structure of project reports show collaboration in terms of a lack of independent writing, analysis, or significant overlap in written material, the student may be severely penalized for plagiarism.
- The university regulations with respect to plagiarism are very strict and the penalties can be very severe, such as being excluded from the course and possible heavy fines.
- *Structure of the report*: It is permissible that the two reports of a project have the same overall structure as dictated by the project itself. Beyond this, the reports must show no evidence of collusion.
- *Illustrations*: It may be inevitable that the illustrations in reports of project partners are very similar; this is allowable. If a figure used that has been solely produced by one of the partners, it should be referenced in the figure's caption.
- To avoid being judged as having collaborated, students are *very strongly advised* not to share digital files or hard copy of written text.

8.1.5 Past years project reports

Past years project reports in pdf file format are located on the S-drive as follows:

S:\student-share\PartIV-Project-Reports\MECH\

8.2 Online submission of the final report (one per student)

The final report is to be submitted digitally. The report together with Appendices should be generated as ONE digital file (pdf format) and submitted by 5 pm, Friday, 29/September (unless advised otherwise in Semester 2):

- Filename format: ProjectNumber-2017-UPI-report.pdf

  e.g. MT034-2017-jblo123-report.pdf

- Submission: Upload to S-drive folder:

  S:\MECH\Submit\MechEng700\FinalRepoers\

Students are very strongly advised to organise the word processing resources well ahead of the deadline. *Also, the amount of time needed for the final formatting should not be underestimated, as it always takes far longer than imagined. IMPORTANT NOTE: Reports submitted after 5.00 pm will be severely penalised - 5 marks (10% of 50) off the examined report marks for late submission of every 24 hours.*

The submission date will be found on pages viii and 4 of this handbook.

8.4 Format of the report

The font of the text should strictly be 12 point Times New Roman. (If Lyx is used, then a 12 point Times Roman font will be acceptable.) Line spacing should strictly be single; and

'before' and 'after' spacing for each paragraph should be at 9 pt. Detailed instructions are given in Appendix A. Failure to conform to the specified formatting requirements will be severely penalised.

The first page should be a title page set out as follows. The text box is of size 105 mm wide by 50 mm high, and is positioned 57 mm from the right hand edge of the paper and 72 mm from the top edge of the paper. It should give the title of the report, student name and project report number. Project report numbers will be available on Canvas at the end of Semester 1.

The second page should give an abstract of no more than 500 words, and again should be formatted exactly as the example second page of the handbook.

8.5 Structure of the report

The fundamentals of writing the final report will be covered/reinforced in a lecture in Week 4 of Semester 2.

The report is written for a professional engineer and not for a lay reader. The examiner will understand the language of engineering but may not be a specialist in the field covered by the report. It should clearly present the results and conclusions of the work with a critical assessment of their significance. It should include all appropriate supporting material such as descriptions of apparatus and experimental procedures, literature survey, observed results and calculation procedures. The aim should be to present the conclusions and to convince the reader of their validity and relevance.

The report MUST be made up of the following sections: Title page; Abstract; Table of Contents; Glossary of Terms; Introduction; Literature Review; Middle sections appropriate to your project work; Discussion; Conclusions; Suggestions for Future Work; Acknowledgements; List of References.

Abstract

This is a miniaturised version of the whole report. It should be self-contained and from it the reader should know the context of the work (i.e., why it was done); the way it was done (the experimental procedures); the results or its outcome; and the main conclusions. It should be as precise and quantitative as possible and no more than 500 words long.

Glossary of Terms, Abbreviations and Nomenclature

These give abbreviations, terms and symbols that need to be defined for the examiners and readers. The second examiner (the non-expert examiner) will be a mechanical or mechatronics engineer who may have no specific detailed knowledge of the area; so some of the terms that second examiner are likely to need, should be defined.

A two-column format with no visible lines is recommended, with the term in the left hand column and its very brief explanation in the right.

Introduction

This should be an introduction to the project; it should give the background of the work and describe WHY it is being done, i.e. its context, relevance, significance, history, etc.

Literature Review

This should give an overview of previous and current work in the area, together with the relevant citations. Sub-headings can be used if necessary. This can be a refined version from the submitted literature review report in Semester 1.

Middle sections relevant to your project work, for example:

Experimental Procedure

Experimental procedure or other suitable headings, appropriate to the work, give details of how the investigation was carried out. Enough details of the equipment and the procedure should be included so that another competent person could repeat exactly what was done, working only from the description.

Results

In this section, the information leading to conclusions about the investigation needs to be given. Graphs and tables merely present data; they don't state results. The student needs to ensure that there is a linking, explanatory text, describing the significant features of the results to the readers. A lecture has been dedicated to “Data Processing and Presentation” in Week 9, Semester 1.

Discussion

The results should be commented upon/discussed and interpreted in relation to the objectives of the work and to other people’s work.

The use of a **Results and Discussion** section could be considered instead of the two separate sections. It is often a more useful and elegant way of presenting and discussing the results.

Conclusions

This should include a series of the conclusions arising from the material in the Discussion. Each one must be directly and logically drawn from the findings. Bullet form with concise writing can be used to present the conclusions drawn from this work. However, be careful about the difference between what is a real conclusion (main outcome) from this work and a statement about what has been done.

Recommendations (if needed)

This gives a list of the recommendations arising from the Conclusions section.

Suggestions for future work

This describes how the student sees the work might progress in the future. In any project, one sometimes finds that all the intended or planned work is not able to be completed; this section is an opportunity to discuss this professionally. Again, bullet points with concise writing can be used to present the suggestions for the future work. Each of the points could be an objective of a future work.

Acknowledgements

This acknowledges the people who have provided help in the project, most importantly the supervisor(s), project partner and technical staff. *This section can also be placed after the Table of Contents*. Make sure the title and the name of the people mentioned are correct.

List of References

This provides a list of all the source material cited in the text. Referencing is one of the most convention-ridden areas of technical documentation, and it is easy to go wrong. Consistency is one of the key attentions need to be paid for this section.

Further details and examples of text and corresponding references section are given in Appendices A (A.3) and C. Appendix C also gives information about formatting the more problematic types of source material (e.g. undated material, project reports, magazine articles, standards, etc.).

Appendices

These contain the detailed material that would interrupt or distort the main account or the report if not separated out. They are there for the specialist reader and can contain, for example, program listings, raw data, lengthy tables, detailed error analyses, working drawings, etc. These need to be properly cited in the main report body. *If they cannot be cited, they do not need to be included.*

8.6 Presentation and style

Appendix A should be referred to for instructions about presentation and formatting.

The appearance of a report has a strong effect on its assessment. The student should make sure that the report is readable, pleasing to the eye, and professional in all its aspects.

Illustrations should be used whenever possible and it should be ensured that any text on graphs and their axes is legible. Photographs should not be pixelated, i.e. enlarged beyond their capabilities. Proper use of annotation on illustrations can enhance the clarity of discussion and facilitate the readability of the report to the readers.

8.7 Length

A long report is not necessarily a good report. The student should avoid inflating it; it should be as concise as possible while still meeting the general requirements given above.

The main text of the final report must not exceed 20 pages*. The student will be penalised if the report is more than 20 pages. The font size (strictly 12 point), line spacing (strictly single), and paragraph spacing (9 pt before and after), etc, should not be altered to be able to squeeze more in. It will be very noticeable to the examiners and the student will be penalised.

NOTE: The **length of a report is measured from the beginning of the Introduction (page 1) to immediately before the start of the References section**.

*Similarly, **the length for the Mid-Year Progress Report** is **10 pages**, measured as above.

8.8 The process of writing the report: suggestions

Most people find that at the end of the year, they have difficulties in staying below the prescribed length of 20 pages. The material therefore needs to be carefully selected. The student may find the following procedure helpful. First, a "brain dump" of key phrases can be done for everything to be included. Then a decision is made on which section (Background, Results etc.) each of these phrases should go into. This is followed by listing all the headings and subheadings that are foreseen for the report, and the sections are arranged in a logical order as in the Contents Page. Then this plan is used to write sections of the rough draft. This plan should not be taken as rigid; it may need to be continually altered as the thoughts come into focus during the writing.

The writing process is started from the easiest section first. This is usually the section in which the experimental procedures are described. This may be followed by writing the section in which the results are described. The more difficult sections can be left until later when thoughts have been sharpened by the writing of the easier parts.

The student should make sure that:

- The accuracy of the data is ensured and presented convincingly.
- There is adequate data to support the conclusions.
- The conclusions relate properly to the stated aims.
- The illustrations are clear, and that any text on the graph or axes is legible. Each figure and table must have a number (e.g. Figure 1; Table 1). A Table needs to have a title, and a Figure needs a caption (explanation), which is placed following its number.
- All the statements are clear and cannot be misinterpreted.
- A mechanical or mechatronics engineer with no detailed knowledge of the work can understand it.

Finally, the grammar and spelling should be checked; any jargon and informal writing removed, and the sentence and paragraph lengths are varied. As an absolutely final stage, the spell checker should be used and then the report closely read for errors. If the English is weak, it is recommended that someone else be asked to read through the report.

8.9 Feedback on your report

The supervisor can give advice on the structure and content of the student's report, but will not proof-read or rewrite it. If problems with writing and/or English are detected after marking of the mid-year report, the supervisor may advise the student to contact the Student Learning Centre. There is also a self-access on-line English course (ELE) in the Student Commons.

8.10 Large amounts of raw data

One must ensure that the final report is self-contained. If there is a lot of additional information (e.g. raw data, code, etc.), these should be included as an Appendix if they are essential for the report. All necessary appendices should be included in the report file. The appendices will not be marked.

8.11 Confidentiality issues

Any confidentiality issues should be discussed with the supervisor and the organisation. If a project is conducted in co-operation with an outside organisation that requires confidentiality, the organisation should be advised that the reports are placed in the library, thus placing the information in the public domain. The organisation may ask for it to be withheld from the library for a given length of time. This should be communicated to the Projects Coordinator at the earliest. It is important that material relevant to the project should not be put onto a web site, for reasons of confidentiality.

8.12 Subsequent publication

Where the project results are new and publishable discoveries, the student is encouraged to prepare papers jointly with the supervisor for subsequent publication.

9 Project Conference

Each project group is required to give a conference presentation about their work. Both the presentation and the display should be regarded as professional engineering occasions. Standard of dress together with the quality and type of material presented should reflect this.

9.1 Mid-year practice presentations (MYPP)

The dates for the mid-year practice presentations will be found on pages viii and 4 of this handbook. A detailed schedule will be available at the beginning of semester 2.

These are practice sessions and not graded, but aim at giving students the opportunity to improve their competency for the final presentations. The following should be noted:

- The MYPP will be a 5-minute presentation of individual work (i.e. 10 minutes per project pair, including the accessing of ppt file from a USB stick). This means one person speaks for the first part, and then the other person speaks for the second.
- Breaking it down into one person doing a bit, then the other, then back to the first, is not allowed.
- This format also applies to the October conference presentation.
- Each group/pair will be videoed during the presentation; and will then immediately have a private discussion with a staff member in another room/area, during which the video will be used to give feedback on the competency of their presentation.
- There will be no time for questions at the MYPP.
- This is not a 'trial by fire', but a friendly opportunity for improvement.
- The MYPPs are not assessed; however, if a student/group does not show up, their supervisor will take it into account when their semester's work is assessed.
- There is no dress code for the MYPP.
- A copy of the assessment form used at the conference presentations is in Appendix D.

IMPORTANT: The students should note the following:

- The presentation (Powerpoint slides or other form) should be brought on a USB stick.
- The presentation must be driven from the USB stick. It may NOT be loaded into the computer.
- The student's own laptop may not be used.
- Movies may not be used in the presentation. At the MYPP, they may not run.
- Each project pair has a strict 10 minutes, including the loading of the file.

9.2 Project conference

The project conference will be held in various lecture theatres in the Business School (Owen G Glen Building, rooms to be confirmed in Semester 2). Each room will have a digital lectern. A detailed schedule will be available in Semester 2. The date for the project conference will be found on pages viii and 4 of this handbook.

The following should be noted:

- The project conference is regarded as a professional occasion that requires ***every student to be present for the entire duration***. The student should make arrangements to ensure that they are present for the whole day.
- The PowerPoint (or any other presentation) files are to be loaded onto the computer desktop as follows: Morning presentations loaded before the start of the first presentation; afternoon sessions loaded during the lunch break.
- Length of time for each project presentation: 8 minutes per student + 4 minutes for questions and interchange = 20 minutes per project pair. No other time combinations are allowed.
- For single-person projects: 12 minute presentation + 4 minutes for questions = 16 minutes total; and this will be at the end of the session.
- A laser pointer will be provided for each session, but not a slide changer.
- The chairperson will give a knock on the desk at 7/11/15 minutes to signal that there is one minute left, and again at 8/12/16 minutes. At the final knock the student will be expected to finish within 30 seconds.

- The schedule is tight; therefore changeovers between presentations will need to be smooth.
- The conference schedule will be made available some time before the event.
- Each room will run approximately from 8.30 am to 4.00 pm; and there will be four sessions in each room throughout the day. However, this could be subject to change.
- Advice from IT: "Students are advised to test their presentations, and in particular, any video clip they want to play in an e-Lectern machine well beforehand. These lectern computers are not similar to the faculty lab machines in any way in this respect and the video format may need to be changed to suit".
- Each student will be required to attend four sessions: attendance sheets will be handed out to be signed at the beginning and end of each session. The four sessions do not need to be in the same room. To minimise the disturbance to the people who are presenting, students will be able to move from one session to another only in the morning and afternoon breaks and at lunchtime.
- Filming during the conference: If a family member or friend is going to film a presentation, he/she needs to ask for permission from the chair of that session.
- A light lunch together with morning and afternoon tea will be provided for staff and students only.
- Dress code: Smart casual.

9.3 Assessment of the conference presentation

The students in each session will be assessed by two members of the academic staff (assessing criteria, see Appendix D)

The fundamentals of making a good oral presentation will be covered in the Project Seminar series in Week 1, Semester 2, before the Mid-Year Practice Presentations, and if necessary, before the final conference presentations.

10 Displays Day and Award Function Evening

Each group will prepare a display to explain its project work.

The dates for the project displays will be found on pages viii and 4 of this handbook. A detailed schedule will be available in Semester 2.

Each display will be situated in one of designated areas on City campus, or in the Leech Study Area (Level 3) - Refer to details placed on Canvas in due course. The session will be open to the general public and invited guests from industry. During the afternoon, guest assessors from industry and the profession will visit each display and discuss the project with the project group. The purpose of the display is to give the students an opportunity to promote their work as it is done in an industrial exhibition. The poster display should be as self-explanatory as possible. A panel of practising professional engineers and guests from industry will assess the displays.

There will be a dinner and awards function at a Hotel (tentatively, Langham Hotel has booked for the 2017 FYP function) for all students and staff together with the assessors and invited guests from industry; beginning at 6.30 pm. Family members cannot be invited to the function. Awards will be presented by the professional groups and organisations.

10.1 General guidelines for the display

For further advice, the students should refer to Appendix E. Important points to note are:

- The displays and setup should be ready by 12.00 pm. Posters will be printed by the department and will be delivered to the display sites in the morning of the Display Day.

- Displays are located in various designated areas (very likely in the MDLSs) and the Leech study area. They should be mostly static (with posters only), but dynamic (with poster and small-size equipment) display can be allowed if deemed fit.
- Any special requirement should be discussed and arranged with the project supervisor and the laboratory technicians. A need may arise to share some equipment.
- The size of the display poster is A1. They will be printed by the department if submitted in electronic format by the deadline (*see page viii or page 4 in this handbook*), otherwise the student group will have to produce their own printed poster and bring it to the display site for the setup. Instructions for formatting and submission of a poster are given below in the following section.
- Both students involved with a project should be in attendance at their display area and will be required to speak about their project and answer questions.
- All project students are required to help with setup and arrangement of the display areas, as well as the tidying up from 5 pm, hand in hand with the lab technical staff and postgraduate student helpers.

10.2 Formatting and submission of the display poster

Formatting of the poster: The students should

- Make sure that the date of the Displays Day (day/month/year) is on the poster.
- Aim for maximum contrast so that the material shows up against any background.
- Use a minimum font of 25 point size for the text of the material (as opposed to that in the title box).
- Think carefully about the colour scheme. Two or three colours should be chosen that work well together. The temptation to go for firework explosion of colours should be avoided. Some useful websites can be found from a Google search for "poster colour schemes".
- Need to be sure that the logo of an organisation that the students are working with is to be included, the logo is not corrupt and will not affect the printing process. This is relatively common with strange logos.
- To see the full-size appearance of the poster, 100% should be selected in the sizing window.

Submission of poster for printing:

- The poster must be submitted as a pdf file.
- The poster file name must have both project partners' UPIs in it, e.g. jdoe456-jblo123-2017.pdf.
- Submission details: see pages viii and 4 of this handbook.
- The posters will be delivered to the designated areas on the day of the displays. Poster boards will be available on site.

10.3 Project function and prizes

The Mechanical Engineering Department's project function will be held immediately after the displays (at a venue to be announced in due course). Prizes for the best displays will be presented at the function by various professional and industrial bodies. Details for this year will be announced later, however in the previous years, some of the prizes awarded were by:

- Heavy Engineering Research Association Prize
- IPENZ-Auckland Branch Mechanical Engineering Group Prizes (2)
- Vibrations Association of New Zealand Prize
- Composites Association of New Zealand Prize
- Royal Aeronautical Society Prize
- Royal Institute of Naval Architects Prize

- Fisher & Paykel Appliances Prize
- Callaghan Innovation Prize
- Crown RTC Prize
- NextWindow Prize
- KiwiBots Prize
- Hyspecs Prize
- Fantail Group Prize
- Mechatronics Staff Prize

11 Project Completion Checklist

The last date for this submission will be found on pages viii and 4 of this handbook.

The Project Completion Checklist (PCC) is on the back of the Project Information Sheet that was submitted to the lab in March. It must be signed off by the ***technical staff member of the assigned lab*** *AND* ***the supervisor****.* It covers the condition of the equipment that were used, the tidiness in which the laboratory has been left, the disposal of any chemicals, and the clearing of data off the computer(s) that were used; as well as the return and forwarding of all borrowed and project related material and files to the supervisor.

The student should ensure (1) the technician; and (2) the supervisor, have BOTH signed it off and then submit it to the *Mechanical Engineering Department Office, Level 9 by 5.00 pm, on the due date (31/Oct/2017).*

NOTE: <u>The student/project will not be cleared for the final grade</u> unless this signed form is submitted to the Mechanical office by this date.

Appendix A Formatting Instructions for the Final Project Report

Note: Severe penalties will be imposed on reports that do not conform to the specified length and formatting requirements of the reports.

These notes summarise the instructions for formatting your Part 4 Project Report.

This template is formatted as per the instructions given. The **Heading** (1 to 3), **Normal**, and **Caption styles** are already formatted accordingly and will not require any re-formatting. The page outline, margins, footer and page numbering are also formatted as per requirements.

Please refer to the Project Co-ordinator for further explanations if you have any doubts. This will also be covered in the project seminars, together with guidelines for using the formatting options in MS Word.

A.1 Font, spacing, margins, justification, page numbering, report length

The main body of the report should be single-sided on A4 (210×297 mm) size paper. It should **strictly be single spaced** and in **Times New Roman font (or Times Roman when Lyx does not offer Times New Roman)**. **The font size should strictly be 12 point**.

The printing area should start 20 mm from the top of the page with a right hand margin of 20 mm, a bottom margin of 20 mm, and a left hand binding margin of 30 mm. The '**Normal margin**' style should be used as in this template.

All paragraphs should have a 'before' and 'after' spacing of 9 pt spacing; the spacing's for headings is given in A1.2 below. Text should be justified. Wherever asked to centre text or section, this will refer to centring relative to the margins.

Page numbers should be at the bottom centre of each page, within the bottom margin (as in this template), Times New Roman font, size 10 pt.

The body of the report, i.e. from the beginning of the Introduction to immediately before the start of the List of References section, should be **no more than 20 pages** in length.

It is recommended that the formatting is checked before finalising the report. Perhaps a sample page can be printed for checking before finalising the entire document in pdf format.

A.2 Headings

The main body should have no more than three levels of headings (e.g. 2, 2.1 and 2.1.1).

The following format for headings should be adopted:

> **Heading 1** – 14 pt bold; Left justified with no indent; 18 pt spacing before and after; Numbered 1 2 3 etc.
>
> **Heading 2** – 12 pt bold; Left justified with no indent; 12 pt spacing before and after; Numbered 1.1 1.2 etc.
>
> **Heading 3** – 12 pt italics; Left justified, no indent; 12 pt spacing before and after; Numbered 1.1.1 1.1.2 etc.

Sections and sub-sections need not start on a new page – the body of the report should just flow continuously.

A.3 Use of references

Detailed information on the styles specifically recommended for use at the Faculty of Engineering can be found via: http://www.cite.auckland.ac.nz/index.html. It is strongly suggested that one of these styles be used, upon consultation with the supervisor:

1. **University of Auckland Engineering (Numbered) Style**: Full details can be found at http://www.library.auckland.ac.nz/subject-guides/ref/uoaeng.htm and in Appendix C (section C.1). References should be quoted in the text by numbers in square brackets (e.g. [1]). They should be numbered in the sequence of their first appearance. This unique number must be used each time this source is cited in your report. References should be listed together at the end of the report in the List of References section, in the numerical sequence in which they appear in the report.
2. **Harvard Referencing Style**: Full details for the use of the Harvard referencing style can be found at http://www.library.auckland.ac.nz/subject-guides/ref/harvard.htm and in Appendix C (section C.2).

Suggestions for problematic references will be found in Appendix C; section C.3; including format and examples for referencing conference presentations and publications.

A.4 Use of SI units

The International System of Units (SI) **MUST** be used throughout your reports. **If you do not do this, your reports will be marked down.**

There are a number of online reference sources. Recommended: National Institute of Standards and Technology (NIST). International System of Units (SI):
http://physics.nist.gov/cuu/Units/units.html

A.5 Abbreviations

Any abbreviations should be spelled out in the first instance of use and followed by the acronym in brackets, e.g. Computer-Aided Design (CAD). Thereafter, the acronym alone will be sufficient.

These terms and their abbreviations must be listed in the Glossary of Terms.

A.6 Mathematical symbols and equations

Mathematical symbols using alphabetical and Greek letters should be in italic. Font size should be 11 pt. **It is important that symbols should also be described in the main text of the report, at least in the first instance of appearance, in addition to the description in the nomenclature at the front of the report**.

Equations should be numbered consecutively throughout the report. Equations should be centred with the equation numbers in round brackets and right justified. If the text is formatted correctly, with 3 pt spacing 'before' and 9 pt spacing 'after', then that will leave sufficient space above and below the equation. For instance, a 3-column table may be used with row-height set at 1.2 cm (12 mm) as follows:

$$y = \mathrm{a}x + \mathrm{b}cosx + \int \frac{e}{cx + d} dx \qquad (1)$$

The numbering in the main body of the report should be consecutive and as shown above and below, starting at 1, and following with 2, 3, etc. For equations occupying wider space, then some adjustment of the table row-height may be done as appropriate. For example a 1.8 cm table row-height is required for the following:

$$z = \mathrm{a}\sin x + \mathrm{b}\frac{x^2}{N} + \frac{\int \frac{e}{cx+d}\,dx}{\int \frac{g}{x^6}\,dx} \tag{2}$$

The above equation lines may be copied for use as templates for equations.

If the above equation were to appear in this appendix as a second equation, then its numbering should carry the appendix letter (A2), as follows

$$z = \mathrm{a}\sin x + \mathrm{b}\frac{x^2}{N} + \frac{\int \frac{e}{cx+d}\,dx}{\int \frac{g}{x^6}\,dx} \tag{A2}$$

A.7 Illustrations: guidelines

All illustrations (figures and tables) should be centred. All symbols and text in illustrations should be of a size that is clearly legible. For table entries, a 10 pt font size is recommended.

A.7.1 Illustrations and captions in the main body of report

All illustrations (figures and tables) should be numbered consecutively in the order of their appearance. One numbering sequence should be used for figures (graphs, photographs, line drawings) and a second for tables, thus: Figure 1, Figure 2, Figure 3, ; and Table 1, Table 2, Table 3,.. , etc.

Each illustration MUST have a caption i.e. figure or table number and a title (e.g. Figure 5 Lift coefficient versus angle of attack). Conventions state that:

- the **figure caption** (i.e. number and title) are centred and placed **below** a figure; and
- the **table caption** (i.e. number and title) are centred and placed **above** a table.

The figure and table 'Caption' style required is formatted in this template: It should be Times New Roman text size of 10 pt, with 9 pt spacing's 'before' and 'after'.

Each illustration **MUST** be referred to by its figure or table number at an appropriate place in the text (for example, Figure 3 shows …; …as shown in Table 2).

An example of a caption for a table follows.

Table 1 Maximum tensile and compressive stresses of the wing bones of Pteranodoningens

Bone	Tensile stress σ_T (MPa)	Compressive stress σ_C (MPa)
Metacarpal	68	73
1st phalanx	70	75
2nd phalanx	113	123
3rd phalanx	215	230
4th phalanx	146	174

An example of a caption for a figure follows**. Note that the title of the figure should be in the caption (as in Figure 1) and not at the top of the figure (as in Figure 2).**

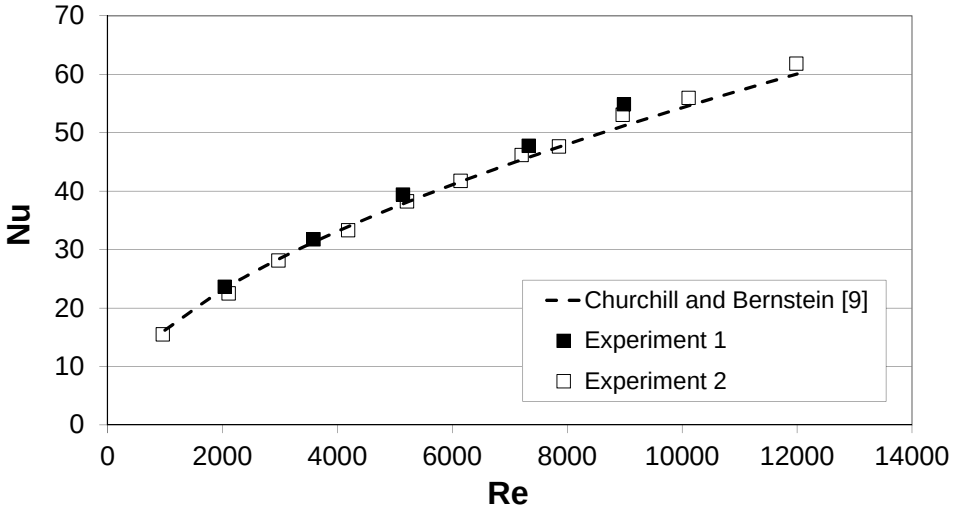

Figure 1 Average Nusselt number as a function of Reynolds number for the heated cylinder

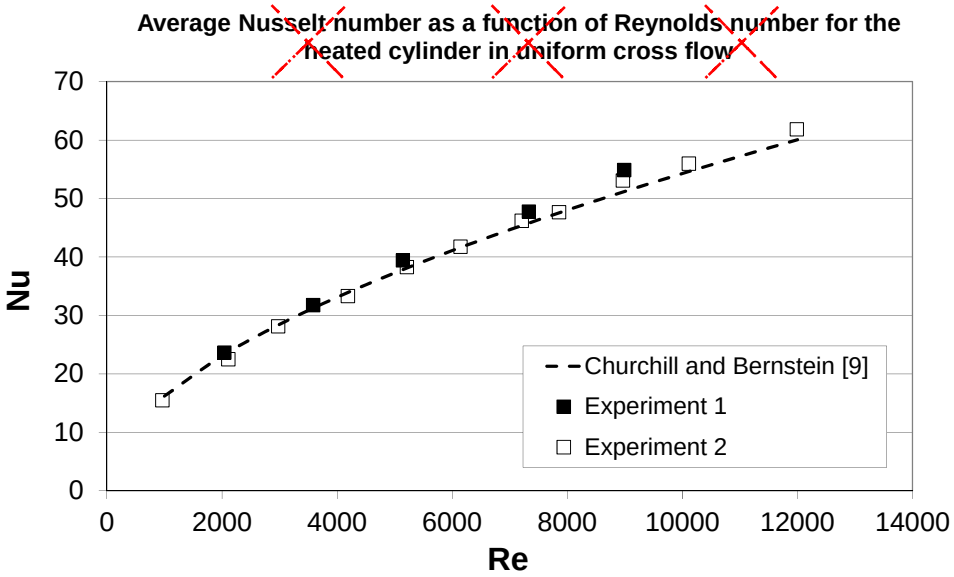

Figure 2 Average Nusselt number as a function of Reynolds number for the heated cylinder

A.7.2 Captions in the appendices

Captions in the appendices will be similar to those in the main report, except for numbering.

A table caption number would start with the appendix number or letter, e.g. Table A1, Table A2, Table A3, or Table C1, Table C2, Table C3, etc..

Similarly, a figure caption number would start with the appendix number or letter e.g. Figure B1, Figure B2, Figure B3, etc..

Appendix B Criteria for the Assessment of the Final Project Report

This is a list of the criteria used by the examiners of the final project report:

Presentation

English

Grammar - Sentence structure; style; case; tense

Spelling

Readability - Does it read well? Is it unambiguous?

Structure

General – Does the order prepare the reader and set the objectives?

Flow /Clarity – Is the material logically presented? Can you find points easily?

Format /Layout - Are the headings, Table of Contents etc., logical?

Abstract – Does the Abstract explain context of the work, methods, results and main conclusion(s)?

Diagrams – Is the quality of the diagrams acceptable?

Are the diagrams necessary? Are there too few diagrams?

Have they been properly acknowledged, if copied?

References - Are they correctly cited? Are they complete?

Bibliography – Are the sources correctly cited?

Appendices - Are they needed? Are they referred to in the main text, etc.?

Technical Content

Literature Review

- Is the quantity and quality of the references sufficient?
- Is the background to the report described and is this material developed?
- Has the basic research been done? (Bear in mind intended readership)

Depth of study

- Has a suitable level of research been achieved? This should go beyond the level of undergraduate BE papers in subject area.
- Does the theory adequately describe the test data?

Quality of the Analysis

- Is this report a professional piece of work?

(It is useful to ask if someone else wanted to extend the work described in this report, could they repeat this study on the basis of the report?)

Technical Synthesis

Discussion - Is the explanation of the results sensible and well founded?

Conclusions - Do they meet the objectives of the project?

Appendix C Guidelines on Referencing

C.1 University of Auckland Engineering (numbered) style

C.1.1 Example: Numbered system of referencing for final year projects – Text and corresponding List of References © Heather Silyn-Roberts, 2012.

Comments

-A second reference to Source Number 1. Note that it is not assigned a new number

-Author mentioned in text

-Three references in a series, separated by commas

-More than three references in a series will be done using a hyphen between first and last reference e.g. [2 – 8]

-Precise placing of references in the text; one referring to the palintonon, and another to the onager

Text

The recent upsurge of interest in the mechanical efficiency of medieval hurling devices has resulted in their use as subjects for student construction projects in engineering [1]. There is also a wealth of web-based material: for instance, graphics and information [2], applications such as desktop models [3], and computer simulations of a trebuchet [4, 5].

Used in ancient times to hurl everything from rocks to plague-ridden carcasses of horses [5] and, in a modern four-storey-high reconstruction, dead pigs, Hillman cars and pianos [1], the trebuchet relied on the potential energy of a raised weight. Its mechanical efficiency has been compared unfavourably by Gordon [6] with that of the palintonon, the Greek hurling device, which could hurl 40 kg stone spheres over 400 metres [7, 8, 9]. This device incorporated huge twisted skeins of tendon, a biomaterial that can be extended reversibly to strains of about 4% [10]. The palintonon utilised the principle of stored elastic strain energy – the fact that when a material is unloaded after it has been deformed, it returns to its undeformed state due to the release of stored energy [11]. The motion of the palintonon [12] and that of its Roman equivalent, the onager [13], has been analysed by use of the energy principle applied to the finite torsion of elastic cylinders.

Comments

1: Article in journal, no volume number
2, 3 4: Electronic sources, each with a cited author

5: Electronic source, with no cited author
6: Editorial in journal
7: Book. Note publisher, place of publication, and relevant page number(s)
8: Article in magazine with volume number in bold face

9: Chapter in book.

10: Book.

11: Book

12: Book.

13: Paper in journal

14: Paper in journal

List of References

1 O'Connor, L. (1994) Building a better trebuchet. *Mechanical Engineering*, January, 66–69.

2 Miners, R. *The Grey Company Trebuchet Page.* Retrieved January 21, 2012 from http://members.iinet.net.au/~rmine/gctrebs.html

3 Toms, R. *Ron L Toms' Products and Services.* Retrieved February 15, 2012 from http://www.rlt.com/

4 Siano, D. *The algorithmic beauty of the trebuchet.* Retrieved January 14, 2012 from http://members.home.net/dimona/

5 *The Virtual Trebuchet.* Retrieved February 1, 2012 from http://www.stud.ifi.uio.no/~oddharry/blide/vtreb.html

6 O'Leary, J. (1994) Reversing the siege mentality. *Mechanical Engineering*, January, 4.

7 Gordon, J.E. (1978) *Structures or Why Things Don't Fall Down*. Penguin, Harmondsworth, pp 78–89.

8 Soedel, W. and Foley, V. (1979) Ancient catapults. *Scientific American*, **240**, 150–160,

9 Hacker, B.C. (1968) 'Greek catapults and catapult technology: science, technology and war in the ancient world.' In: *Technology and Culture*, **9**, No. 1, pp 34–50.

10 Marsden, E.W. (1969) *Greek and Roman Artillery*. Clarendon Press, Oxford. Pages 86–98.

11 Wainwright, S.A., Biggs, W.D., Currey, J.D. and Gosline, J.M. (1992) *Mechanical Design in Organisms*. Second edition. Longman, Harlow. Page 83.

12 Benham, P.P., Crawford, R.J. and Armstrong, C.G. (1996) *Mechanics of Engineering Materials.* Second edition. Longman, Harlow. Page 67.

13 Hart, V.G. (1982) The law of the Greek catapult. *Bull. Inst. Math. Appl.*, **18**, 58–68.

14 Hart, V.G. and Lewis, M.J.T. (1986) Mechanics of the onager. *J. Eng. Math.*, **20**, 345–365.

C.1.2 Referencing conference papers using University of Auckland Engineering (numbered) style

Conference paper - paper presented at conference:

Format:

No Paper author, AA. (year of publication) Title of paper, paper presented at *Name of conference*, Place of conference, date-date Month year.

No Paper author, AA. (year of publication) Title of paper, paper presented at *Name of conference*, Place of conference, date-date Month year, viewed day Month year, <URL>

Example:

9 Abbott, K. & Seymour, J. (1997) Trapping the papaya fruit fly in North Queensland, paper presented at the *Australian Entomological Society conference*, Melbourne, 28-30 September.

12 Bayne, S. & Ross, J. (2007) The 'digital native' and 'digital immigrant': a dangerous opposition, paper presented at the *Annual Conference of the Society for Research into Higher Education (SRHE)*, Brighton, Sussex, 11-13 December 2007, viewed 9 October 2011, <http://www.malts.ed.ac.uk/staff/sian/natives_final.pdf>.

Conference paper - paper published in conference proceedings:

Format:

No Paper author, AA. (year of publication) Title of paper, *Title of conference proceedings*, Publisher, Place of Publication, pp. xx-xx.

Example:

11 Gleeson, L. (1996) Inside looking out, *Proceedings of the 3rd national conference of the Children's Book Council of Australia*, D.W. Thorpe, Port Melbourne, pp. 46-53.

C.2 Harvard referencing style

C.2.1 Example: Harvard system of referencing for the text and reference list in C.1.1.

Comments

-One to three authors, all author surnames followed by year e.g. Benham, Crawford, and Armstrong (1996)

-More than three authors, first author followed by et al, then year e.g. Wainwright et al (1982)

Text

The recent upsurge of interest in the mechanical efficiency of medieval hurling devices has resulted in their use as subjects for student construction projects in engineering (O'Connor, 1994). There is also a wealth of web-based material: for instance, that on graphics and information (Miners, 2012), on applications such as desktop models as discussed by Toms (2012), and on computer simulations of a trebuchet as discussed by Siano (2012) and at *The Virtual Trebuchet* (2012).

Used in ancient times to hurl everything from rocks to plague-ridden carcasses of horses (*The Virtual Trebuchet*, 2012) and, in a modern four-storey-high reconstruction, dead pigs, Hillman cars and pianos (O'Connor, 1994), the trebuchet relied on the potential energy of a raised weight. Its mechanical efficiency has been compared unfavourably with that of the palintonon by Gordon (1978), the Greek hurling device, which could hurl 40 kg stone spheres over 400 metres (Gordon, 1978; Soedel and Foley, 1979; Hacker, 1968). Marsden (1969) showed that this device incorporated huge twisted skeins of tendon, a biomaterial that can be extended reversibly to strains of about 4%. The palintonon utilised the principle of stored elastic strain energy – the fact that when a material is unloaded after it has been deformed, it returns to its undeformed state due to the release of stored energy (Wainwright et al, 1982). The motion of the palintonon (Benham, Crawford, and Armstrong, 1996) and that of its Roman equivalent, the onager (Hart and Lewis, 1986), has been analysed by use of the energy principle applied to the finite torsion of elastic cylinders.

Comments

See earlier comments in C.1

Arranged in alphabetical order of first author name

List of References

Benham, P.P., Crawford, R.J. and Armstrong, C.G. (1996) *Mechanics of Engineering Materials.* Second edition. Longman, Harlow. Page 67.

Gordon, J.E. (1978) *Structures or Why Things Don't Fall Down.* Penguin, Harmondsworth, pp 78–89.

Hacker, B.C. (1968) 'Greek catapults and catapult technology: science, technology and war in the ancient world.' In: *Technology and Culture*, **9**, No. 1, pp 34–50.

Hart, V.G. (1982) The law of the Greek catapult. *Bull. Inst. Math. Appl.*, **18**, 58–68.

Hart, V.G. and Lewis, M.J.T. (1986) Mechanics of the onager. *J. Eng. Math.*, **20**, 345–365.

Marsden, E.W. (1969) *Greek and Roman Artillery*. Clarendon Press, Oxford. Pages 86–98.

Miners, R. *The Grey Company Trebuchet Page.* Retrieved January 21, 2012 from http://members.iinet.net.au/~rmine/gctrebs.html

O'Connor, L. (1994) Building a better trebuchet. *Mechanical Engineering*, January, 66–69.

O'Leary, J. (1994) Reversing the siege mentality. *Mechanical Engineering*, January, 4.

Siano, D. *The algorithmic beauty of the trebuchet.* Retrieved January 14, 2012 from http://members.home.net/dimona/

Soedel, W. and Foley, V. (1979) Ancient catapults. *Scientific American*, **240**, 150–160

The Virtual Trebuchet. Retrieved February 1, 2012 from http://www.stud.ifi.uio.no/~oddharry/blide/vtreb.html

Toms, R. *Ron L Toms' Products and Services.* Retrieved February 15, 2012 from http://www.rlt.com/

Wainwright, S.A., Biggs, W.D., Currey, J.D. and Gosline, J.M. (1992) *Mechanical Design in Organisms*. Second edition. Longman, Harlow. Page 83.

C.2.2 Referencing conference papers using Harvard style

Conference paper - paper presented at conference:

Format:

Paper author, AA. (year of publication) Title of paper, paper presented at *Name of conference*, Place of conference, date-date Month year.

Paper author, AA. (year of publication) Title of paper, paper presented at *Name of conference*, Place of conference, date-date Month year, viewed day Month year, <URL>

Example:

Abbott, K. & Seymour, J. (1997) Trapping the papaya fruit fly in North Queensland, paper presented at the *Australian Entomological Society conference*, Melbourne, 28-30 September.

Bayne, S. & Ross, J. (2007) The 'digital native' and 'digital immigrant': a dangerous opposition, paper presented at the *Annual Conference of the Society for Research into Higher Education (SRHE),* Brighton, Sussex, 11-13 December 2007, viewed 9 October 2011, <http://www.malts.ed.ac.uk/staff/sian/natives_final.pdf>.

Conference paper - paper published in conference proceedings:

Format:

Paper author, AA. (year of publication) Title of paper, *Title of conference proceedings*, Publisher, Place of Publication, pp. xx-xx.

Example:

Gleeson, L. (1996) Inside looking out, *Proceedings of the 3rd national conference of the Children's Book Council of Australia*, D.W. Thorpe, Port Melbourne, pp. 46-53.

C.3 How to reference problematic sources

Note: If the author is not stated

Describe the source as fully as possible, in the style of the relevant examples below. The order of the items cited is:

- The title of the document should be cited first
- Date (when possible)
- The organisation/institution that produced the document.
- Any identifying number, such as designation code, or contract number.

For citation in the text: use the first few words of the title.

Thesis	Johnson, C.E. (2005) A Study of Residual Stresses in Titanium Metal Matrix Composites. PhD Thesis, University of Middletown.
Student report (including your project partner's report)	Tsoi, T.S. (2006) Development of a modular planar positioning platform and crystal unit reorientation system. Part IV project report, 2006-MT25.
Lecture material	If the writer's name is stated: Carter, R. (2012) Robotics. Lecture handout, Engineering and Society, The University of Middletown. If the writer is unknown: Wetlands (2012). Lecture handout, Conservation Ecology**,** The University of Middletown.
Newspaper article	Author is known: Nicholson-Lord, D. (1995) Does work make you stupid? Independent on Sunday, 29 January, p 21. Author is unknown: Could alcohol be good for your liver? The Week, 13 November 1999.
Magazine article	Author is known: Hibbert, L. (2007) Natural products. Professional Engineering, 21 November, 20-21. Author is unknown: Shades of green (1998). Consumer, Number 344, 21-24.
Technical report	Hilley, M.E. Ed. (1971) Residual Stress Measurement by X-Ray Diffraction. SAE Information Report J784a, Society of Automotive Engineers, New York.
Government and legal documents • The first element of information is the government department, committee or body. The last two may also be referenced by the name of the chairperson. • Include the complete title.	CORINAIR Working Group on Emission Factors for Calculating 1990 Emissions from Road Traffic, 1 (1993). Commission of the European Committees (Office for Official Publications, Luxembourg).
Section of an Act of Parliament	Risk assessment and notification requirements (1990) Environment Protection Act 1990 (c. 43), Part VI - Genetically Modified Organisms, Section 108. Act of Parliament, United Kingdom. Her Majesty's Stationery Office, London.

Report by a professional body	Recycling Household Waste - The Way Ahead (1991). Association of Municipal Engineers, The Institution of Civil Engineers, London.
Engineering codes	Building Code Requirements for Reinforced Concrete and Commentary (1989). ACI Committee 318, American Concrete Institute, Detroit.
Standard specification	Standard Specification for Urea-Formaldehyde Molding Compounds (1994). Designation D705-94. , American Society for the Testing of Materials, Annual Book of ASTM Standards 1999. **08.01** Plastics (I), 92-93.
Standard test method	Standard Test Methods for Thermoplastic Insulations and Jackets for Wire and Cable (1996). Designation D2633-96. American Society for the Testing of Materials, Annual Book of ASTM Standards, 1998, **10.02** Electrical Insulation (II), 25-38.
Standard practice	Standard Practice for Algal Growth Potential Testing with Selenastrum capricornutum (1993). Designation D-3978-80 (Reapproved 1993). American Society for the Testing of Materials, Annual Book of ASTM Standards 1997, **11.05**, Biological Effects and Environmental Fate; Biotechnology; Pesticides, 29-33.
Patent	Kuhn, K. J., Wehner, W., Zinke, H. (2000) Stabilizer combination for chlorine-containing polymers. US Patent number 6 013 703.
Map	Swansea and The Gower (1974) Ordnance Survey Sheet 159, 1:50 000, First Series. Director General of the Ordnance Survey, Southampton.
Consulting report Include **name of consulting firm**, **contract number** and **for whom** the report was prepared**.**	Wylie Stream Intake Feasibility Report (1997). James Consultants Ltd., Contract TKA 99/136. Prepared for Middletown Central Electricity Generation.
Undated documents Put (undated) where the date is normally placed.	Predicting Traffic Accidents from Roadway Elements on Urban Extensions of State Highways. (undated). Bulletin 208, New Zealand Highway Research Board.
Fact/data sheet: no author, undated	Twintex TPP fact sheet (undated). Verdex International S.A.
Formal interview	Reidy, H. (2012) In interview, April 3.
Someone has told you something useful	Either in the Acknowledgements or As a pers. com. Example in List of References: 4. A.J. Brown, pers. com.

Appendix D Assessment of Mid-year and Conference Presentations

- Below is part of the assessment sheet used at the October conference presentations.
- This will NOT be used at the MYPP, but your assessor may refer to a number of these points during your feedback session.

As indicator only: Assessment sheet used for the conference presentations

Structure (introductory remarks, key points, logically presented story, concluding remarks)		
Rambling; illogical.	0 1 2 3 4 5	Well-structured; understandable.
Content	**As indication only: won't be used in MYPP**	
Irrelevant; Uninteresting; too much/too little detail.	0 1 2 3 4 5	Relevant; interesting; right amount of detail.
Quality of visual material		
Poorly conceived and prepared.	0 1 2 3 4 5	Well conceived; well prepared.
Integration of visual material with the talk		
Does not support the spoken material.	0 1 2 3 4 5	Well integrated.
Vocabulary (spoken and written) and fluency		
Inappropriate vocabulary; non-fluent.	0 1 2 3 4 5	Appropriate vocabulary; fluent.
Professionalism of the presentation (commitment, involvement, proper use of notes, voice level and stance)		
Poor.	0 1 2 3 4 5	Excellent.
Technical competency of the project work		
Technically incorrect and/or simple.	0 1 2 3 4 5	Technically correct and challenging.

Appendix E Advice about Project Display Day

1. Poster collection

Your posters will be delivered on the displays day to the designated areas in which you are displaying your project.

2. The judging rounds

- There are two judging rounds: the first one is to assess the displays; the second one to decide on the prizes.
- The first round will start any time after 12.30 pm. You need to be fully set up by 12.00 noon at the latest.
- **First round of judging:** There will be teams of judges, each one accompanied by an academic member of staff. The team of judges will spend about 10 minutes per project talking to the two students and looking at their display.
- To get you to speak, the judges are likely to do one of two things (or both): Ask you to tell them about it, or ask you questions. Be prepared for either.
- IMPORTANT: the judges may have no specialist knowledge of your area. You need to remember this when explaining your project to them.
- **Second round of judging:** The second judging round will decide the prizes. The possible prize-winners will have been identified in the first round, and only these projects will be visited in the second round. On this round, the judges will be from the professional institution in that area of knowledge, i.e. they'll have specialist knowledge and are therefore likely to ask more searching questions.

3. Be prepared for visits from staff from other departments and the public.

Faculty staff has been invited to visit you from 1.00 pm onwards. The publicity person will also visit during that time. The public (your family, etc.) can visit between 3.00 and 5.00 pm; during this time the display area can be very crowded indeed.

4. Name tags

Each student, staff member, judge and guest needs to have a name tag. These need to be the official ones prepared by the department. You can collect these in the morning of the displays day from the technicians in your laboratory.

5. Assessment

You'll be assessed on the poster, the technical content, and the professionalism of the presentation. Total of 10 points, 10% of project final marks.

6. The project dinner

Please note: We regret that no partners, family, etc. can attend the dinner. The guests will consist of only the students, staff, invited guests from industry and the judges.

The dinner starts with drinks and nibbles at 6.00 pm, with the dinner starting at 6.30 pm. The prize giving ceremony will take place between the first and second courses.

7. Drinks and drinks tickets

You may not bring your own liquor to the dinner.

In your name tag are two drinks tickets which can be used for either wine or beer before the meal. Wine, juice and water will be on each table during the dinner.