Laboratory 1 – Engineering Reporting
To be performed on Monday, January 21, 2013
Due on Monday, January 28, 2013

I — Introduction:

Besides having good technical skills and being experts in their field, all engineers must demonstrate outstanding communication skills that are essential for presenting results of their work. Any engineering work is not of much value unless it is communicated clearly and concisely. If you cannot make the case, no matter how good the science and technology may be, you are not going to see your ideas realized.

The formal medium for written communication is the "engineering report". Because the engineering report is so important (both in the learning process and in practice), it is one of the first educational requirements on your road to becoming a qualified and competent professional. While the format is likely to vary slightly from course to course (and in practice), all engineering reports have the same basic structure. That structure is introduced and applied in this laboratory. Once the basic structure is mastered, reporting becomes a relatively easy exercise.

*All ECOR 1010 laboratory submissions are to be **formal**, according to the following format:*

Title Page: In formal reports a title page identifies the title of the report, the person or affiliation for whom the report is intended (in your case this is your Teaching Assistant), the author (in your case this is your name and student number), and date. You should note that the date is critical in engineering reporting for many reasons. For instance, establishing a potential patent may depend on the date of an engineering report.

Table of Contents, List of Figures, and List of Tables: Generally, these are all included in professional engineering reports; however, *you may omit them in your laboratory submissions (but not in your project)* because your reports will be relatively short.

Introduction: The introduction section provides the reader with the background necessary to understand the report and provides 'context' for the reader. It begins with a brief overview of what the laboratory was about, and then follows with the reason(s) for doing the work and for submitting the report.

Of special importance is a clear concise statement of the objective(s) at the end of the introduction. Note that even if you may feel that the objective for doing one or another ECOR 1010 laboratory is that it is required to pass the course, this does not introduce the reader to the engineering exercise at hand and therefore such an objective is not relevant. The objective(s) must focus on the technical work in the exercise.

Personal pronouns should generally not be used in technical reports. You should write "The experiment was done . . . " instead of "I did the experiment . . . ".

Method: This section details the steps (procedure) used to fulfill the *objective* stated in the introduction. Describe how the objective was investigated. If you develop a clear, concise statement for the purpose of the laboratory and keep this clearly in mind while detailing the method, then writing this section should be easier to do.

Results and Discussion: In this section, the results of your work are presented followed by a discussion of your assessment of what the results mean. It is important that this section be written in a clear and concise fashion. Tables, graphs, and drawings are often included to support the discussion. Make sure to explain to the reader the importance of the tables and graphs with some words in the text; simply including graphs and tables without explaining why they are there is not done. References can be made to the Appendix (see description below) in which detailed calculations are presented. In addition, only the results relevant to the *objective* are to be included. Interesting results and experiences that may have appeared in the laboratory but are not related to the objective are to be included as part of the Appendix. The point is that the report must be focused on the *objective* at all times.

Any difficulties or anomalies encountered in the investigation are included in the discussion after the results have been presented. The significance of the findings is also included in this section.

Conclusions: This brief section lists the specific conclusions arrived at on the basis of the work described in the report. Conclusions are to be significant and pertinent. State whether the *objective* was achieved. Often the conclusions are two or three bulleted or numbered statements, but a short paragraph is also acceptable.

References and Acknowledgements: References and acknowledgements are contained in long engineering reports. They *will not be necessary* in your ECOR 1010 write-ups, including the project, again because you are being asked for very brief reports.

Appendices: Sketches, drawings, tables, calculations and graphs should be attached to the report as *appendices*. Note that each appendix must contain text to indicate clearly the relevance of the content to the report.

Engineering reports generally are no longer than absolutely necessary. In this course, the entire length of a report (excluding the Title Page and Appendices) is limited to **ONE PAGE.** **Reports should be written using the template file on cuLearn where the font size and the margins have been set for you.**

The software tools used to write engineering reports generally consist of the following:

- Word processing (e.g., Word) – all students are assumed to have word processing skills;
- Table setting (e.g., Word or Excel) – all students are assumed to have spreadsheet skills;
- Graphing (e.g., Excel);
- Equation setting (e.g., Word Equation Editor);
- Sketching software (e.g., IntelliCAD) – software sketching is not expected in Laboratory 1. This will be the focus of Laboratory 2.

II — Problem Statement:

The fundamental goal of engineering is to ensure our technology is safe for the public to use: safety of the public is the first priority for all engineering. Safety can have an immediate effect: buildings and bridges have to stay standing, electrical devices cannot electrocute people, water must be free of harmful substances, and nuclear reactors must operate in a controlled way. Safety is also important in the long term. More and more, engineers are being asked to design and build things with a long-term regard for safety, where safety is now more broadly defined. Engineers are being asked to help limit the harm our generation does to the environment so that future generations can enjoy the same world we enjoy today. In this context, engineers are finding ways to minimize our energy consumption and reduce greenhouse gas production, which are two problems that are generally believed to pose a threat to future societies. There are no simple solutions, and often balances are found between competing factors.

Transporting people long distances requires large amounts of energy and produces large quantities of greenhouse gas, however, different modes of transportation are going to be more-or-less energy efficient and harmful to the environment. So, how do we choose the 'best' mode of transportation?

Concerns for energy and the environment have prompted vehicle manufacturers to become creative in how they present their products to the public, often by being imprecise. In this lab you will be asked to consider an aircraft manufacturer who claims that people travelling by air consume approximately half the fuel that a person would travelling by automobile. In contrast, the automobile manufacturer says that people should travel by car because they will consume less fuel than travelling by air, roughly half, and produce fewer carbon dioxide emissions. Can they both be right? (Fuel consumption is the reciprocal of fuel efficiency, which is the energy efficiency of a vehicle – lower fuel consumption means higher fuel efficiency.)

Manufacturers can be expected to describe their products and services in the best way they can, and engineers are expected to challenge and investigate these claims to ensure the products are safe and reliable. Engineers challenge authorities, in a professional way; it is part of our job. Engineers cannot rely on an opinion that a bridge will stand, we need to do our own analysis. In this case, the authorities are the manufacturers and your job is to investigate their claims and arrive at your own conclusions.

You will estimate fuel consumption and CO_2 production for travel by aircraft and automobile and present your findings in a brief formal report.

III — Steps and Calculations:

You are asked to report total fuel consumption, and per capita fuel consumption, for a trip from Halifax to Vancouver in three vehicles: the BlueSky model E-1010 aircraft, a generic 4-passenger sedan car, and a generic 7-passenger minivan. In addition, you are to report total, and per capita, fuel costs and CO_2 emissions along with an estimate of the number of trees you would need for a year to fix the CO_2 emitted. Finally, travel times will also be reported. You will use these results to support your assessments of the claims of which mode of transport consumes the least amount of fuel and emits the least CO_2. You are provided technical information in Tables 1 and 2, and a list of plausible assumptions that you will use to estimate the values in Table 3, which you will use to defend your conclusions.

Table 1: "BlueSky" model E-1010 airplane specifications.

Aircraft model	Max. no. of seats	Max. range*	Max. takeoff weight	Max fuel capacity**	Cruise speed @ 35,000 feet ***
		(Km)	(Kg)	(kg)	(Km/h)
E-1010	250	4655	67775	32389	89#

*The maximum distance the airplane can fly without using its reserve fuel.
**The maximum mass of fuel the airplane can hold in its fuel tanks including its reserve fuel.
*** "#" is your last digit of your student number plus 1 (e.g., if the last two digits of your student number are 43, then in "#" you should have 44).

Table 2: Useful Information

Automobile fuel price*	1.2#	$/L
Fuel density (aircraft and automobile)	0.80	kg/L
Aircraft reserve fuel*	10.#0	%
Automobile average speed*	8#.00	km/hr
Aircraft fuel price**	TBD	$/L
Automobile CO2 emission	2.35	kg/L
Airplane CO2 emission	3.16	kg CO2/kg Fuel
Halifax to Vancouver distance by car	5811	km
CO2 fixed by the average tree per year	50.0	lb CO2/tree/year

* "#" is your last digit of your student number.
** To Be Determined (TBD)

Assumptions

1. For the E-1010, the Halifax-Vancouver flight is the maximum range of the airplane. This is the distance the airplane can travel without using its reserve fuel. For your calculations, the mass of reserve fuel is 10.#0 % of the maximum fuel capacity, where # is the last digit of your student number. The reserve fuel is only used if the airport is busy, or if the flight needs to be diverted because of bad weather.
2. When calculating travel time by air, assume an average speed equal to 95% of the cruise speed for the airplane.
3. When calculating travel time by automobile, include 12 hours of rest for every 10 hours of driving. For the average automobile speed use 8#.0 km/hr, where # is the last digit of your student number.
4. For the price of jet fuel, use the average price over the last 13 months: see Figure 1.

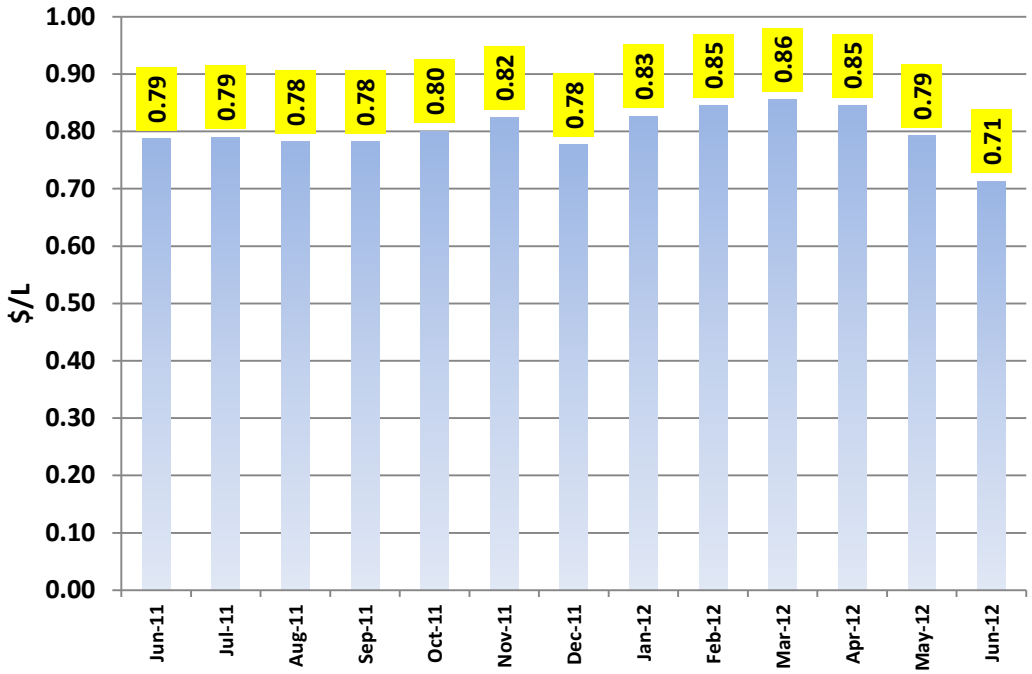


Figure 1: Jet fuel monthly price in Canada ($/L)

Table 3: Calculation Summary Table

	Fuel Consumption L/100 km	Fuel Cost for the vehicle to travel the distance ($)	Fuel Consumption per person: 100% occupied seats L/100 km	Fuel Cost per person: 100% occupied seats ($)	CO2 Emission (kg)		Total Travel Time (hr)*	Total Travel Time **		No. of trees to offset CO2 emission /yr/person
					Total	per person: 100% occupied seats		*hr*	*min*	
E-1010 250 passengers										
Car– Sedan 4 passengers	6.%%									
Minivan 7 passengers	8.%%									

* The total travel time by automobile includes 12 hr rest stops for each 10 hr of driving; report to 4 sig figs
**Convert total travel time to hours and minutes; for instance, 6.2 hrs means 6 hrs and 12 min.
"%%" are the last two digits of your student number.

NOTE:
- Pay attention to the number of significant figures **("sig figs":** see chapter 11 section 6 of the textbook).

IV — Report Requirements and Deliverables:

Write your report using the "Lab 1" template on cuLearn. This template includes reproductions of the tables in Section III that you will use to present the results of your calculations. Handwritten entries are acceptable in the tables, but the body of the report must be typewritten.

- Using a word processor and the provided cuLearn Lab 1 template, write a formal engineering report of your findings and submit it to your lab section Teaching Assistant. The report must be compiled according to the ECOR 1010 format discussed earlier. You should include in the Appendix (or Appendices):
  - your sample calculations – these can be hand written as engineer's notes (neatly and in ink);
  - 3 tables produced as outlined in Section III ("Steps and Calculations");

- In the "Results and Discussion" section of your report, among other things, you should:
  - Mention the significance of the results obtained in Section III;
  - Present a brief qualitative and quantitative comparison of fuel consumption for the three vehicles.
  - Address the manufacturer's claims: use the results of your calculations in Table 3 to support your conclusions. Specifically,
    - Can the aircraft manufacturer claim that people should fly because it is more efficient when compared with one person driving, because fuel consumption will be approximately half?
    - Can the automobile manufacturer claim that people travelling in an automobile consume approximately half the fuel they would have consumed if they had made the same trip by air.
  - Comment on which mode of transport results in fewer CO_2 emissions.
  - Briefly evaluate the validity and accuracy of your conclusions in the light of the assumptions.

- Don't forget that the written text of the report must be no longer than one page. Additional material is to be included as appendix pages — sketches, figures and tables, etc. Remember that the figures and tables must be properly labelled and supported with text in the results and discussion, as described above. Avoid leaving any important data in Appendices unmentioned and unsupported in the body of the report.

Deliverables Summary
The lab assignment includes the following pages:
1. Title page
2. One-page report
3. In appendices: Tables 1, 2 and 3 (typed or handwritten); Supporting calculations (typed or handwritten); sign and date the bottom of the pages
4. *IMPORTANT:* submit an electronic version of your assignment to the P: drive folder*

***File name: "LabSection_Student number.doc OR .docx" (e.g. "D2_100812345.doc": would be the filename for the student with student number 100812345 in Lab section D2)**

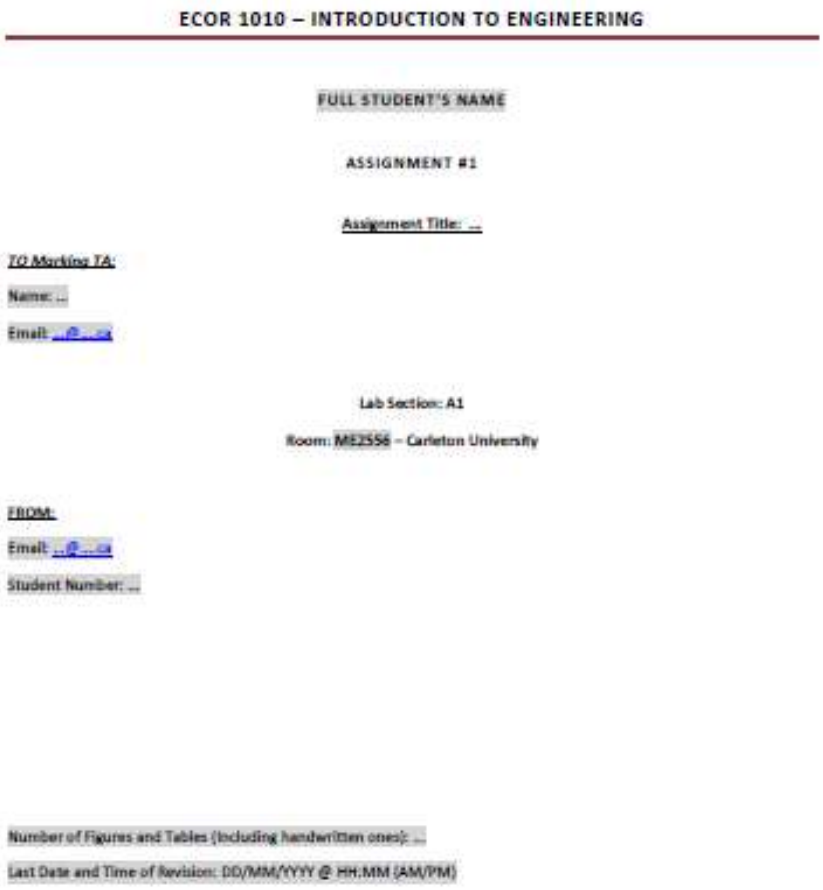
V — Submission and Timing:

Your report is to be submitted to your Teaching Assistant within the first 30 minutes of your next laboratory period (on January 28th, 2012). **LATE SUBMISSIONS WILL NOT BE ACCEPTED.**

VI — Marking:

Laboratory submissions will be marked on a 10-point scale: 9-10 (excellent); 7-8 (good); 5-6 (marginal); less than 5 (poor). **Be sure that you are familiar with the University's policy on plagiarism and academic integrity. Your instructors are obligated to report all suspected violations to the Associate Dean's office for investigation (see also chapter 14 at www4.carleton.ca/calendars//ugrad/current_ /regulations).**

VII – ECOR 1010 Lab Template: Available on cuLearn, an example of the Title page is shown below



ECOR 1010 – INTRODUCTION TO ENGINEERING

FULL STUDENT'S NAME

ASSIGNMENT #1

Assignment Title: ...

TO Marking TA:

Name: ...

Email: ...@...ca

Lab Section: A1

Room: ME2556 – Carleton University

FROM:

Email: ...@...ca

Student Number: ...

Number of Figures and Tables (including handwritten ones): ...

Last Date and Time of Revision: DD/MM/YYYY @ HH:MM (AM/PM)