

## Technical Report Writing

### Writing Style and Format Requirements

#### Appearance

1. Word process the body of the report, from the title page through the conclusions.
2. Figures should be embedded in the report, attached with spray adhesive or rubber cement, or scanned and inserted.
3. Use the 12 point Times or Times New Roman fonts for your text, figure captions, and table headings. Use a 12 point Arial or Calibri font for text in figures.
4. Use a one-inch margin on all four sides. Do not right justify the text.
5. Double space the text of the report. Single space title, date, & location. Single space table & figure descriptions.
6. Put page numbers on all pages, starting with 1 on the title page. Page numbers are placed one-half inch from the top edge and one inch from the right edge. Use the Header feature of Word to automatically place your page numbers.
7. A header identifying the lab report immediately precedes the page number on all pages: EE 330 Lab Report 0. Leave five spaces between this header and the page number.

#### Tense and Voice

1. Write in the passive voice: “Strain gages were used with a Wheatstone bridge to determine the bending stress in the cantilever beam.”
2. Avoid -ing verbs with the passive voice (especially avoid the words “using” and “utilizing”):  
RIGHT: With a Wheatstone bridge, . . . or A Wheatstone bridge was used to . . .  
WRONG: Using a Wheatstone bridge, . . .
3. Use present tense for the Objective, Background, Results and Conclusions section and any time you state general rules or truths: “The relationship between uniaxial stress and strain is  $\sigma = \epsilon E$ .”
4. Use past tense for the Procedure/Experiment section. Tell what was done and what happened in your particular case.

#### Spelling, Punctuation, and Word Selection

1. Use a colon only where a period would fit.
2. Put a comma before the conjunction (and, or, but) in lists of three or more.
3. Set off the words “therefore,” “however,” with (a) comma(s).

4. Spell out contractions (cannot, is not, could not, etc.).
5. Use a plural verb for the word “data”: the data are (were); the datum is (was).
6. Do not write in first person [I, me, my]. The report should be objective.
7. Second person pronouns are unacceptable--do not use the word “you” as in “You will see . . .”
8. Avoid non-technical language. Avoid the words “thing” and “stuff” as they relate no information.
9. Avoid the word “there” everywhere in the report. It does not carry any information. Choose more specific words.
10. Avoid referring to measurements by their units (“The psi in the cylinder was 34.”). Instead, use the dimension to refer to the measurement (“The pressure in the cylinder was 34 psi.”).

### Labeling, Referencing, and Placement of Tables and Figures

Tables present numerical or textual material or information in a regular array. Figures present sketches, pictures, charts, graphs, etc. Put the independent values in the first column of a table and on the horizontal axis of plots when possible.

1. Mention each table and figure in the text before it appears in the report. Tables and figures should appear on the same page or on the next available page after they are mentioned. Do not leave large gaps at the bottom of a page if a figure or table will not fit. Continue the text and put the figure or table at the top of the next page.
2. Number and label each table and figure in order, e.g. Table 1, Table 2, etc., not Table 1.1, Table 1-2, etc. Tables are numbered independently of figures and not consecutively as one group.
3. Tables and figures are centered on the page within the one inch margins.
4. A modified version of the APA style for table headings and figure captions should be used. Note that the table title and the figure number are italicized as shown below.

Table 1

*Force Sensor Specifications*

Figure 1. Experimental setup for filter test.

5. Title each figure and table. Note that table titles are placed above the table, while figure titles (these are called captions) are placed below the figure.
6. Acknowledge all figures taken directly from any source. Failure to do so is PLAGIARISM! Follow the example below.

Figure 6. Opposed piston engine (Bell & Parker, 1997).

APA Style Tables (from <http://web.indstate.edu/mary/tables.htm>)

- The first part of a table is the table number. Tables are numbered with Arabic numerals in the order of appearance.
- The next part is the table title. The table title should be upper and lowercased, centered, and double-spaced below the table number. The title should be italicized as well. Double space again after the table title before the actual table begins.
- Next is the first horizontal line of the table, which separates the table title from the column headings.
- Use upper and lowercase letters in the column headings. The column heading is the label, which is centered over each column. Column headings are not boldface, italicized, or underlined.
- A second horizontal line separates the column headings from the table data. Table data must be in the same style and size font used for the report’s text. It should also fit within the boundaries of the page’s margins.
- The table is ended with a final horizontal line. Any table notes should follow this last line, being designated by Note. and followed by a period.
- These three horizontal lines are the only lines that are required for an APA style table. In some cases additional horizontal lines may be used for clarification (American Psychological Association, 2001).
- Strict APA style does not allow the use of vertical lines. Check with your instructor if you want to use vertical lines in a table.
- You may single-space the table data. In strict APA style, the entire table is double-spaced, just like the rest of the paper.

Correct APA style table (modified slightly for EE 330):

Table 1

Desired and Actual Frequencies for Low Pass Filter Experiment

Desired Frequency (Hz)	Actual Frequency (Hz)	Desired Frequency (Hz)	Actual Frequency (Hz)
10	8	800	800
15	16	1500	1600
30	32	3000	3200
80	80	8000	8000

Incorrect APA style table (too many horizontal lines, vertical lines, Arial font):

Table 1.				
Desired and actual frequencies for low pass filter experiment				
Desired Frequency	Actual Frequency		Desired Frequency	Actual Frequency
(Hz)	(Hz)		(Hz)	(Hz)
10	8		800	800
15	16		1500	1600
30	32		3000	3200
80	80		8000	8000

### Formatting Figures and Graphs

1. You should not use scanned or copied figures taken directly from any lab handout or course notes in your lab report.
2. All figures should be neatly drawn, either by hand or by computer. All plots of data must be computer generated with Excel, Matlab, or an equivalent program.
3. Plot the independent variable along the abscissa (“X axis”) and the dependent variable(s) along the ordinate (“Y axis”).
4. Use appropriate scales for each axis: Divisions of 1, 2, 5, 10, or multiples are preferred. Avoid awkward fractions along labeled divisions (computer programs are particularly bad about this). Show 0 on the scale unless this would compress the data unnecessarily.
5. Label the horizontal axis across the bottom of the plot, and the vertical axis along the left hand edge. A “secondary” vertical axis is sometimes provided along the right hand edge.
6. Label each axis with units as well as variable names. If you are plotting two or more variables along the ordinate, use multiple scales (or log scale) if a single scale would compress one set of data excessively.
7. Use similar scales for plots of similar data (perhaps the same experiment run with two different settings).
8. Align each figure so that it reads normally or from the right-hand edge of the page, (i.e., the page should be bound along the left or top side).
9. Plot theoretical relationships along a smooth line or curve, without individual data points (since any point along the curve is equally valid).
10. Plot empirical relationships with individual data points and smooth curves of the appropriate mathematical type. For example, a plot of measured resistance vs. displacement for a potentiometer would use a “best-fit” straight line, since this is the expected relationship.
11. Draw measured data not supported by theory or empirical formula as distinct data points without any lines. Make data points large enough to be easily read.

Some specific comments about graphs in Microsoft Excel

12. Use the X-Y (Scatter) plot option for most of your plots--not Line plot (which equally spaces X axis data). The only exception to this rule is when no independent variable exists. An example of this case would be plotting the experimentally measured resistance of several resistors.
13. The default placement of the X and Y axis can be changed on the Format Axis – Scale option under “Value (X or Y) axis Crosses at \_\_\_\_”.

Equations

1. Provide the reference for all equations taken from another source, including a textbook or a handout. Embed the reference in the text; do not put the reference on the same line as the equation:

“Bernoulli's equation for incompressible flow is given by Equation 15.2 of Beckwith, Buck, & Marangoni (1982) as

$$\frac{P_1 - P_2}{\rho} = \frac{V_2^2 - V_1^2}{2g_c} = \frac{(Z_2 - Z_1)g}{g_c} \quad (1)$$

2. Define all symbols immediately after they are first used:

Mechanical output power is calculated from the formula

$$P = \tau\omega \quad (2)$$

where

P is the power (typically horsepower or watts),

T is the torque (typically ft-lbf or N-m), and

ω is the angular velocity in RPM (revolutions per minute).

3. Number each equation sequentially in parentheses as shown. The equation can then be referenced by number: “Equation (2) was used to compute motor power output.”
4. Center equations, and number them along the right margin, e.g., see example 2.
5. Refer to a numbered equation with a capital E: Equation 1. If you use the abbreviations “Eqn” or “Eq.” and “Eqns.” or “Eqs.,” do so consistently.
6. Place each equation on a separate line. Unless the equation is universally well known or very short, division should be shown on two separate lines. Note the ambiguity in the first two examples below and the clarity of the third.

Not acceptable:  $Y_{max}=3*Pa^4/16*E*t^3*(1-v^2)$  (4)

Not acceptable: 
$$Y_{\max} = 3P_a^4 / 16Et^3(1 - u^2) \quad (5)$$

Acceptable: 
$$Y_{\max} = \frac{3P_a^4}{16Et^3(1 - u^2)} \quad (6)$$

- Equations should be generated using the Equation Editor that is included with Microsoft Word.

## References

All references must be specifically mentioned in the text of your report. References are cited in two different places: in text as part of the information within a sentence; OR in text parenthetically not as part of the sentence’s direct information [in which case they are put into parentheses]; AND in the references section. If a reference is cited by authors’ names in the text, the date should immediately follow in parentheses. The date only has to be stated the first time it is mentioned within a paragraph. When it is mentioned again in the next paragraph, the date must be restated. The names are separated by “and.” If a reference is cited parenthetically, the names and date are put in parentheses together. The names are separated by an ampersand (&). In the references section, the names are also separated by an ampersand.

Here are the two ways reference citations can appear in text: 1) “... Wheeler and Ganji (1996) give the equation for gain as ...” or 2) “Gain is the ratio of output amplitude to input amplitude (Wheeler & Ganji, 1996).” Note that both authors and dates are given in each style. Spell out the names for one or two authors. For three or more authors, name all of the authors the first time ( “Cuttino, Woodbury, and Parker (1996) described a process for group writing of reports.”), but use “et al.” for all subsequent references (“Cuttino et al. (1996) also described ...”).

Several examples of references using the APA style are listed below. References number 5 (Degelman & Harris, 2000) and number 6 (A guide for writing research papers, APA style, n.d.) listed below can be consulted for additional examples. The APA style for reference listings requires that references be listed alphabetically with a hanging indent format as shown below. Note that strict APA style requires the reference list to be double-spaced, but single-spacing the entries with a double-space between entries can be used.

Example for a book listing:

Franklin, G. F., Powell, J. D., & Emani-Naeini, A. (2002). Feedback control of dynamic systems (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Example for an article or chapter in an edited book:

Norton, H. N. (1997). Transducers and sensors. In D. Christiansen (Ed.), Electronic engineers' handbook (pp. 13.1-13.50). New York: McGraw-Hill.

Example for a magazine article:

Viterna, L. A. (1998, July). Hybrid electric bus. Power Conversion and Intelligent Motion, 24, 38-47.

Example for a journal article:

Parker, J. K., Bell, S. R. & Davis, D.M. (1992). An opposed piston engine. Journal of Engineering for Gas Turbines and Power, 115, 734-741.

Example for a web document on university program or department Web site (with copyright):

Degelman, D., & Harris, M. L. (2000). APA style essentials. Retrieved May 18, 2000, from Vanguard University, Department of Psychology Website: [http://www.vanguard.edu/psychology/index.cfm?doc\\_id=796&nbsp](http://www.vanguard.edu/psychology/index.cfm?doc_id=796&nbsp)

Example for a stand-alone web document (no author, no date):

A guide for writing research papers, APA style. (n.d.). Retrieved October 13, 2008, from <http://webster.commnet.edu/apa/>

Note that web addresses can be and should be divided so that the type continues to the right margin. They can be forcefully split after a period or a slash only. The “shift-Enter” option in Word (instead of the “hard” Enter) often works well to force a split in a desired spot without causing other formatting problems.