Title Here

Last Name, First Name

Section #### Date

*Abstract*—These instructions give you guidelines for preparing papers for EML 3301C, EML 4314C, and EML4304C*.* Use this document as a template if you are using Microsoft Word *2010* or later. Otherwise, use this document as an instruction set. Your reports will use only black font, but we have used blue font for instructions specific to the CONTENT of your reports, and black font for primarily formatting guidance. Do not cite references in the abstract. An abstract should have three components: 1) a clear statement of the objectives, 2) background information required to understand how the objectives were achieved, and 3) a brief summary of the important results. Items 2 and 3 should support the objectives. The abstract exists independently from the rest of the paper. It should not refer to anything in the paper.

*Index Terms*—About four key words or phrases in alphabetical order, separated by commas.

# INTRODUCTION

T

HIS document is a template for Microsoft *Word* versions 2010 or later. The document is located on the class Canvas site.

The introduction has two main components: 1) a clear statement of the objectives, and 2) background information required to understand how the objectives were achieved. The introduction exists independently from the abstract and should be written as if the abstract does not exist. Although the introduction has similar components as the abstract, it should have much more detail.

The introduction should not be a tutorial on the topic. It should include information the reader needs to understand the details of what you did to achieve the objective. Generally, no more than three paragraphs are required for a good introduction: A paragraph introducing the topic and the challenge being addressed, a paragraph establishing the background theory or previous work, and a paragraph stating the specific objectives/hypotheses/aims of the present study.

The document format is to be followed. The document contains formatting instructions and should be read and understood. Type over sections of the document or cut and paste from another document and use markup styles. The pull-down style menu is at the left of the Formatting Toolbar at the top of your *Word* window (for example, the style at this point in the document is “Text”). Highlight a section that you want to designate with a certain style, then select the appropriate name on the style menu. The style will adjust your fonts and line spacing. **Do not change the font sizes or line spacing to squeeze more text into a limited number of pages.** Use italics for emphasis; do not underline.

To insert images in *Word,* position the cursor at the insertion point and either use Insert | Picture | From File or copy the image to the Windows clipboard and then Edit | Paste Special | Picture (with “float over text” unchecked).

# Procedure

*Level I Subheading*

The procedure section, often called the Materials and Methods section, is a sufficiently detailed explanation of what you did that a motivated reader could reproduce your results. Be sure to report what you did in a *consistent* voice (either first person or third person) and tense (usually past tense). You may cite specification sheets, class notes and assignment documents for minute details, but be sure the reader can understand all the important parts of your activity from your written description.

Please submit your manuscript electronically for credit. Name the file last name, first initial, lab number, with underscores, i.e. “Doe\_J\_2.pdf.” Convert the Word file to a .pdf and submit it by the required time.

## Level II Subheading

Before you submit your final version, ensure it is in two-column format, including figures and tables. Check the justification of all text to ensure it is distributed evenly between margins. The first page is page 1, but not numbered, subsequent are, top right hand. Make sure the .pdf you submit is readable. The submission will be checked for plagiarism.

## Level II Subheading

Format and save your graphic images using a suitable graphics processing program that will allow you to create the images as PostScript (PS), Encapsulated PostScript (EPS), or Tagged Image File Format (TIFF), sizes them, and adjusts the resolution settings. If you created your source files in one of the following you will be able to submit the graphics without converting to a PS, EPS, or TIFF file: Microsoft Word, Microsoft PowerPoint, Microsoft Excel, or Portable Document Format (PDF). See Fig. 1 for an example of a one column illustration.

*Level I Subheading*

Most charts graphs and tables are one column wide (3 1/2 inches or 21 picas) or two-column width (7 1/16 inches, 43 picas wide). If the image is two columns wide, it must be at the top or bottom of the page. Best practice is to reference an image or equation before it occurs in the text, but it absolutely must be referenced in the text, even if that appears after the graphic.

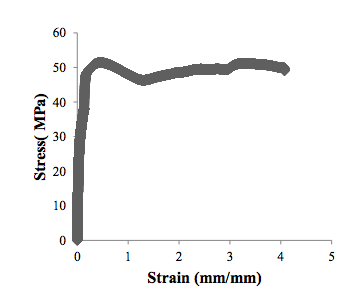


Fig. 1. Stress v. strain for nylon sample. Note that “Fig.” is abbreviated. There is a period after the figure number, followed by two spaces. It is good practice to explain the significance of the figure in the caption.

*Level I Subheading*

Figure captions are placed at the bottom of the illustration. Figures are numbered with Arabic numbers. Figures should not have bounding boxes. Do not connect discrete data points on graphs. This would imply a functional relationship that should be defined if done. It can be appropriate to show a trend line on a graph of data. The paper will be printed in grey scale for grading. Chose appropriate markers to allow the reader to differentiate data in graphs (data markers are too big if they mostly or completely overlap).

*Level I Subheading*

Captions for tables should be at the top of the table. Roman numerals should be used to number tables. Table I illustrates correct format.

# Results

The results section MUST include a written description of the key observations and findings of the exercise. Essentially, you must provide the reader with a written high-level tour of your results that allows them to look at and make sense of your graphical and tabular information. Tables and graphs should be referred to in parentheses in support of a statement, rather than as the subject of a sentence. For example, the sentence “Increasing loop times significantly increased the amount of step-response overshoot (Fig. 1).” is more active and definitive than the sentence “Figure 1 shows the relationship between loop times and step-response overshoot.” Generally, there should be at least one sentence (or paragraph) describing the key findings for each of the study aims/objectives. The Results section should contain no interpretation of the results or comparison with previous work – that belongs in the Discussion section.

If you are using *Word,* use either the Microsoft Equation Editor or the *MathType* add-on (http://www.mathtype.com) for equations in your paper (Insert | Object | Create New | Microsoft Equation *or* MathType Equation). “Float over text” should *not* be selected.

TABLE I

Units for Magnetic Properties

|  |  |  |
| --- | --- | --- |
| Symbol | Quantity | Conversion from Gaussian and  CGS EMU to SI a |
| Φ | magnetic flux | 1 Mx → 10−8 Wb = 10−8 V·s |
| *B* | magnetic flux density,  magnetic induction | 1 G → 10−4 T = 10−4 Wb/m2 |
| *H* | magnetic field strength | 1 Oe → 103/(4π) A/m |
| *m* | magnetic moment | 1 erg/G = 1 emu  → 10−3 A·m2 = 10−3 J/T |
| *M* | magnetization | 1 erg/(G·cm3) = 1 emu/cm3  → 103 A/m |
| 4π*M* | magnetization | 1 G → 103/(4π) A/m |
| σ | specific magnetization | 1 erg/(G·g) = 1 emu/g → 1 A·m2/kg |
| *j* | magnetic dipole  moment | 1 erg/G = 1 emu  → 4π × 10−10 Wb·m |
| *J* | magnetic polarization | 1 erg/(G·cm3) = 1 emu/cm3  → 4π × 10−4 T |
| χ*,* κ | susceptibility | 1 → 4π |
| χρ | mass susceptibility | 1 cm3/g → 4π × 10−3 m3/kg |
| μ | permeability | 1 → 4π × 10−7 H/m  = 4π × 10−7 Wb/(A·m) |
| μr | relative permeability | μ → μr |
| *w, W* | energy density | 1 erg/cm3 → 10−1 J/m3 |
| *N, D* | demagnetizing factor | 1 → 1/(4π) |

Vertical lines are optional in tables. Statements that serve as captions for the entire table do not need footnote letters.

aGaussian units are the same as cgs emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.

# Discussion

The Discussion section should contain at least three main parts: The first paragraph should provide a concise restatement of the study context, objectives and key results. Subsequent paragraphs should interpret study findings (what do they mean?) and relate them to previously published work or established engineering principles. Finally, at least one paragraph should highlight the key technical, experimental or procedural limitations of the study and establish the scope over which the study findings might apply (e.g. the results apply only to similar systems, or to every engineering system in the universe). This limitation paragraph can be the last of the Discussion section, or it can be the second paragraph of the Discussion section, depending upon your style preference.

Use either SI (MKS) or CGS as primary units. (SI units are strongly encouraged.) English units may be used as secondary units (in parentheses). For example, write “15 Gb/cm2 (100 Gb/in2).” An exception is when English units are used as identifiers in trade, such as “3½-in disk drive.” Avoid combining SI and CGS units, such as deflection in meters and area in square centimeters. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity in an equation.

# Conclusion

## Level II Subheading

The Conclusion section generally will be one concise paragraph summarizing the key findings of the present work, stating the importance or impact of the findings on the field of application, and suggesting next steps or future efforts to reach higher levels of performance or impact. (As a single-paragraph section, it will not require subheadings.)

Large figures and tables may span both columns. Place figure captions below the figures; place table titles above the tables. If your figure has two parts, include the labels “(a)” and “(b)” as part of the artwork. Please verify that the figures and tables you mention in the text actually exist. **Please do not include captions as part of the figures. Do not put captions in “text boxes” linked to the figures. Do not put borders around the outside of your figures.** Use the abbreviation “Fig.” even at the beginning of a sentence. Do not abbreviate “Table.” Tables are numbered with Roman numerals.

Figure axis labels are often a source of confusion. Use words rather than symbols. As an example, write the quantity “Stress,” or “Stress *σ*,” not just “*σ*.” Put units in parentheses. Do not label axes only with units. As in Fig. 1, for example, write “Magnetization (A/m)” or “Magnetization (A\*m−1),” not just “A/m.” Do not label axes with a ratio of quantities and units. For example, write “Temperature (K),” not “Temperature/K.”

Multipliers can be especially confusing. Write “Stress (kPa)” or “Stress (103 Pa).” Do not write “Stress (Pa) × 1000”. Figure labels should be legible, approximately 8 to 12 point type.

## Level II Subheading

Number citations consecutively in square brackets [1]. The sentence punctuation follows the brackets [2]. Multiple references [2], [3] are each numbered with separate brackets [1]–[3]. When citing a section in a book, please give the relevant page numbers [2]. In sentences, refer simply to the reference number, as in [3]. Do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] shows ... .” Please do not use automatic endnotes in *Word*, rather, type the reference list at the end of the paper using the “References” style. Cite figures in the figure label or in the first figure reference.

Please note that the references at the end of this document are in the preferred referencing style. Give all authors’ names; do not use “*et al*.” unless there are six authors or more. Use a space after authors’ initials. Papers that have not been published should be cited as “unpublished” [4]. Papers that have been accepted for publication, but not yet specified for an issue should be cited as “to be published” [5]. Papers that have been submitted for publication should be cited as “submitted for publication” [6]. Please give affiliations and addresses for private communications [7].

Capitalize only the first word in a paper title, except for proper nouns and element symbols. For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [8].

## Level II Subheading

Define abbreviations and acronyms the first time they are used in the text, even after they have already been defined in the abstract. Abbreviations such as IEEE, SI, ac, and dc do not have to be defined. Abbreviations that incorporate periods should not have spaces: write “C.N.R.S.,” not “C. N. R. S.” Do not use abbreviations in the title unless they are unavoidable.

## Level II Subheading

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). First use the equation editor to create the equation. Then select the “Equation” markup style. Press the tab key and write the equation number in parentheses. To make your equations more compact, you may use the solidus ( / ), the exp function, or appropriate exponents. Use parentheses to avoid ambiguities in denominators. Equations should be center justified in the column with the equation number right justified in the column.

|  |  |  |
| --- | --- | --- |
|  |  | (1) |

Equation (1) is written in the equation editor, and displayed in a three-column table. The equation is placed in the second column and center justified. The equation number is typed in the third column and right justified. The first column is the same size as the third column and is left blank. The table and cell borders are turned off. This process results in an equation that is center justified in the column and an equation number that is right justified in the column.

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. Italicize symbols (*T* might refer to temperature, but T is the unit tesla). Refer to “(1),” not “Eq. (1)” or “equation (1),” except at the beginning of a sentence: “Equation (1) is ... .”

## Level II Subheading

Use one space after periods and colons. Hyphenate complex modifiers: “zero-field-cooled magnetization.” Avoid dangling participles, such as, “Using (1), the potential was calculated.” [It is not clear who or what used (1).] Write instead, “The potential was calculated by using (1).”

Use a zero before decimal points: “0.25,” not “.25.” Use “cm3,” not “cc.” Indicate sample dimensions as “0.1 cm × 0.2 cm,” not “0.1 × 0.2 cm2.” The abbreviation for “seconds” is “s,” not “sec.” Do not mix complete spellings and abbreviations of units: use “Wb/m2” or “webers per square meter,” not “webers/m2.” When expressing a range of values, write “7 to 9” or “7-9,” not “7~9.”

A parenthetical statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.) In American English, periods and commas are within quotation marks, like “this period.” Other punctuation is “outside”! Avoid contractions; for example, write “do not” instead of “don’t.” The serial comma is preferred: “A, B, and C” instead of “A, B and C.”

The word “data” is plural, not singular. The subscript for the permeability of vacuum µ0 is zero, not a lowercase letter “o.” The term for residual magnetization is “remanence”; the adjective is “remanent”; do not write “remnance” or “remnant.” Use the word “micrometer” instead of “micron.” A graph within a graph is an “inset,” not an “insert.” The word “alternatively” is preferred to the word “alternately” (unless you really mean something that alternates). Use the word “whereas” instead of “while” (unless you are referring to simultaneous events). Do not use the word “essentially” to mean “approximately” or “effectively.” Do not use the word “issue” as a euphemism for “problem.” When compositions are not specified, separate chemical symbols by en-dashes; for example, “NiMn” indicates the intermetallic compound Ni0.5Mn0.5 whereas “Ni–Mn” indicates an alloy of some composition NixMn1-x.

Be aware of the different meanings of the homophones “affect” (usually a verb) and “effect” (usually a noun), “complement” and “compliment,” “discreet” and “discrete,” “principal” (e.g., “principal investigator”) and “principle” (e.g., “principle of measurement”). Do not confuse “imply” and “infer.”

An excellent style manual and source of information for science writers is [9]. A general IEEE style guide and an *Information for Authors* are both available at <http://www.ieee.org/web/publications/authors/transjnl/index.html>

Appendix

Appendixes, if needed, appear before the acknowledgment.

It is suggested that an appendix be included that details the uncertainty analysis performed for the work reported. A table detailing all measurement uncertainty should be included first, followed by propagation of error through the calculations performed. For measurements made, the uncertainties used and the source/reference for them must be listed.  For material properties/other constants used, the uncertainties used and the source/reference for them must be listed.  For RSS based propagation, relevant symbolic representations of what factors were considered uncertain must be included.  The previous required uncertainties are to include all used in the RSS analysis.  Relevant symbolic representation means the RSS applied to the constituent equations, with symbolic representation of the appropriate partials.  Formation of the partials and evaluation of the partials is NOT required, and inclusion is not expected.  For simulation-based propagation of uncertainties, the inputs to the simulation and the results of the simulation are required.  Graphical representation is not required.  Examples of the results of the uncertainty analysis are to be shown in the appendix, and uncertainties are to be reported for ALL reported values, measured, or calculated, unless otherwise directed.

References

1. G. O. Young, “Synthetic structure of industrial plastics (Book style with paper title and editor),” in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.
2. W.-K. Chen, *Linear Networks and Systems* (Book style)*.* Belmont, CA: Wadsworth, 1993, pp. 123–135.
3. H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.
4. B. Smith, “An approach to graphs of linear forms (Unpublished work style),” unpublished.
5. E. H. Miller, “A note on reflector arrays (Periodical style—Accepted for publication),” *IEEE Trans. Antennas Propagat.*, to be published.