

PREPARING YOUR ECE SENIOR THESIS

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Abstract

This document offers guidance on the preparation of senior theses in the Electrical Engineering and Computer Engineering programs. The document was generated from the Microsoft Word template, “ECE 499 template.dotx,” which can be downloaded from the ECE 499 wiki. Format and style requirements are outlined, and advice on writing and use of the template is given.

Note to LaTeX users: LaTeX style files and documentation for graduate theses are available at <http://go.illinois.edu/ecethesis>. The graduate thesis title page will require manual adjustment for an undergraduate thesis; otherwise, the output of the graduate style files is acceptable for undergraduate theses. A LaTeX-generated document will have a very different appearance from a Word document generated from “ECE 499 template.dotx,” but it should still meet all the requirements spelled out here.

Subject Keywords: ECE 499; Senior Thesis; technical writing; scientific writing

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1. Introduction

1.1 Purpose

Senior Thesis is written in ECE 499 to document the rationale, methodology, and results of the Senior Research Project conducted under ECE 496.

Write the thesis to an imagined audience of engineers and scientists who are knowledgeable in your field.

1.2 Draft Review and Grading

The thesis will be checked for language and format by the ECE Editorial Services staff who review ECE M.S. and Ph.D. theses, and for technical adequacy by your instructor (thesis advisor).

The draft thesis should be submitted in hard copy (single-sided, white, no stapling) to Editorial Services for review no later than 10 days before Reading Day. In addition, email a PDF file to Editor Jamie Hutchinson at jhutchin@illinois.edu. The thoroughness of the Editorial Services review will be based on time available, so responsibility for correct formatting, as well as good style and grammar, rests ultimately with the student and the advisor. The final revised copy of the thesis should be presented to the thesis advisor and electronically deposited to the ECE department at the end of the semester. For specific due dates, follow the ECE 496-499 wiki site at go.illinois.edu/ece496-499.

1.3 Publication in IDEALS

The thesis will be published in the Illinois Digital Environment for Access to Learning and Scholarship (IDEALS, www.ideals.illinois.edu), where researchers worldwide will be able to find your title and abstract through a keyword or author search. However, *access to the PDF file will be restricted to University of Illinois users only*, except in the case of outstanding work recommended for global access by the faculty advisor. To expedite the publication process for ECE staff, please name your PDF file according to the scheme in Figure 1.



Figure 1. Naming scheme for final PDF of thesis.

1.4 Summary

This guide describes all the components of a successful senior thesis. Chapter 2 introduces the most standard outline for your subject matter, although you and your advisor may decide to organize the work differently. Chapter 3 introduces the template “ECE 499 template.dotx” and its use in achieving good thesis format. Chapter 4 addresses the main points of good technical style for writing, and Chapter 5 covers the all-important topic of figures and tables. Chapter 6 offers final words of advice and points to further resources for authors. Appendices A and B contain, respectively, a guide to symbols and abbreviations, and a handy checklist.

2. Outline of Subject Matter

2.1 Abstract and Subject Keywords

The abstract is a concise (no more than 300 words) summary of the main findings of the research. Get right to the point. Imagine a researcher who encounters your abstract in a literature search: They need to know what you have found and whether the full thesis is relevant to their own work. Save discussion of background and motivations for the introduction and literature review.

ECE staff will use your subject keywords to deposit the thesis in IDEALS (see Section 1.3). Confer with your advisor about the best keywords. Provide at least one, and separate multiple keywords by semicolons. You may want to refer to the IEEE Taxonomy:

https://www.ieee.org/content/dam/ieee-org/ieee/web/org/pubs/taxonomy_v101.pdf

2.2 Introduction

The first chapter of the thesis immediately following the table of contents is the introduction. In this chapter (starting on page 1) you briefly describe the science or engineering problem to be addressed in the thesis. The chapter concludes with brief descriptions (a few sentences) of the contents of the upcoming chapters and a summary of the main conclusions of the thesis research (elaborated in more detail in the final chapter).

2.3 Literature Review

The second chapter of the thesis should present a critical review of prior work published in the literature that is directly relevant to the problems addressed in the thesis. Explain what aspects of the previous approaches to the problem are to be superseded by the work described in the thesis. If your advisor does not require a traditional, thorough literature review, you should at least dedicate a chapter to summarizing the research context of, and motivation behind, your work.

2.4 Description of Research Results

The next set of chapters will describe the main body of research work undertaken in your study. One chapter can be dedicated to experimental techniques, or numerical techniques, or any other methodology applied to the research problem. The subsequent chapters should show the specifics of research work, including derivations, proofs, measurement results, etc., as appropriate. Use as many chapters as needed to present the thesis work in a logical and organized manner. These chapters will typically contain diagrams, data plots, mathematical equations, code snippets, etc., depending on the nature of the thesis.

Material that is important but may disrupt reading of the main text—such as lengthy code, data tables, schematics, certain proofs, and detailed discussion of laboratory equipment and processes—should be placed in an appendix.

2.5 Conclusion

This is the last chapter of the thesis. Bring together, concisely, the conclusions to be drawn from the results of the thesis study. Also discuss unresolved issues and make suggestions for future work. As much as possible, use words only, with few or no figures, tables, or equations.

3. Format

3.1 “ECE 499 template.dotx”

To create your thesis, use the template “ECE 499 template.dotx,” from which the document you are reading now was created. Double-clicking the template opens an untitled Word document that you can save with any name you like. Replace the red text and bracketed section heads with your own, and adapt the structure to your needs. (Note that the line spacing in this document is narrow, but your thesis should be spaced at 1.5 or 2. Red text in the template is spaced at 1.5.)

3.2 Format Standards

You may change the styles for text, headings, figure captions, etc., in “ECE 499 template.dotx,” as long as you output a document that meets the following standards:

- Preliminary pages are numbered with small roman numerals, except the title page, which has no page number. (To achieve this, “ECE 499 template.dotx” incorporates a section break after the preliminary pages, with “Different first page” checked in the Header and Footer tab for the preliminary pages, but not the main text.)
- Table of contents (TOC) is neat, accurate, and consistent in the depth (level of headings) represented for each chapter. Use the automatic TOC feature provided—and be sure to hit the Update tab!
- Chapter 1 starts on Arabic page number 1, and the rest of the thesis, including appendices, follows from that. (Do not use independent page numbering for appendices.)
- Each chapter starts on a new page. Line spacing for text is 1.5 or 2.
- Preliminary sections (abstract, contents) have chapter status graphically, but are not included in the TOC. (“ECE 499 template.dotx” achieves this by matching the font and color of chapter titles, but stripping out the Heading 1 style, which is “read” by the auto TOC generator.)
- Numbering of chapters and sections is logical. “ECE 499 template.dotx” will not automatically update numbers when sections and chapters are inserted and deleted, so keep track and proofread the thesis!
- References and appendices have chapter status graphically and are included in the TOC, but they are not numbered as chapters.
- Margins are at least one inch on all sides. Watch margins when you insert figures, tables, and equations!

3.3 References

“ECE 499 template.dotx” provides IEEE “templates” for most kinds of sources you will need to cite. If you need to cite something for which there is no template, simply use common sense and provide—in a neat and orderly manner emulating the IEEE reference style—the information necessary for another researcher to find that source. If you have many references, you may want to use a software package such as OneNote or RefWorks to keep them organized. These packages (along with BibTeX for LaTeX) automatically update citations and numbering as you develop and revise the text.

Your advisor may prefer that you use a reference style other than IEEE; for instance, in remote sensing it is customary to use Radio Science (AGU) style, and researchers in microelectronics often use AIP. The software packages mentioned above will output any style. If you are doing it manually, consult the guides available on the ECE Thesis Check wiki at <http://go.illinois.edu/ecethesis>. Reference style guides, as well as templates and software, are also available online at the various journal/society web sites.

Custom reference styles may be permitted if they meet scholarly standards and are consistently adhered to.

References [1]–[3] (in both the template and this document) are examples of a manual, datasheet, and web page, respectively. References [4]–[7] are more standard, scholarly sources: a book, chapter in an edited book, journal article, and conference proceedings. Reference [8] is a technical report, and reference [9] is class notes. Cite all references consecutively in the text, as is done here, unless your reference list is organized alphabetically.

4. Technical Style

Write in a formal style and neutral tone without letting your writing become dull and lifeless. Use active voice as much as possible, and employ variety in sentence structure. Avoid wordiness, affectation, awkwardness, and gobbledygook. Use past tense to report transitory results and completed actions (e.g., “The resistance was 10 Ω until we replaced R1”). Use present tense to report final results and discussion (e.g.: “The completed circuit operates at 2.5 kHz,” “A simple explanation of these findings is that ...”). Avoid frequent and arbitrary changes in verb tense.

4.1 Units of Measure

Express quantities with an Arabic number, followed by a space, followed by an IEEE-recommended abbreviation for the unit of measure (see Appendix A). IEEE takes its lead from the International System of Units, which provides a single, coherent measurement system for researchers worldwide. Examples:

0.2 pA, 127 μm , $0.574 \times 10^{-3} \text{ mm}^2$, 10 k Ω , 120 A, \$5500.00

Note that units of measure are *not* italicized. (The only exception is μ , which may be italicized; e.g., 127 μm .)

When discussing units without quantities, use words not symbols (“A millimeter-scale device”).

4.2 Numbers

In general, use words for numbers up to 10 (e.g., one, two, three), and use numerals for numbers 10 and up. Exceptions:

- Always use a word at the beginning of a sentence: “Forty trials were run.” (You may wish to recast as “We ran 40 trials.”)
- Unless at the beginning of a sentence, quantities with units of measure are always numerals: 3 mm, 5 V.
- Numbers used as nouns are usually set as numerals: Chapter 3, sample 16, device 2, step 5.
- When comparing, within a paragraph, numbers that are above and below 10, make them all numerals: “In trials 1 and 2, we completed 8 and 15 runs, respectively.”
- If two numbers that would normally be set as numerals appear next to each other, it may be best to change the lowest number to words: “We completed sixteen 45 min trials.”
- In some cases it may be clearer to spell out zero and one than to use numerals 0 and 1.

4.3 Mathematics

Mathematical expressions that are referenced later in the text should be displayed (not in-line) and numbered according to the same system as, but in a sequence independent of, figures and tables. Displayed expressions should be centered (preferred) or indented, with numbers (if used) in parentheses flush right. Insert any punctuation after the equation, not the number. (Such terminal punctuation is not required, but if used it must be applied consistently. The easiest style is simply to have no punctuation after equations.) Text references to numbered equations should be capitalized, with parentheses preceded by a space: “Equation (2.1) shows”

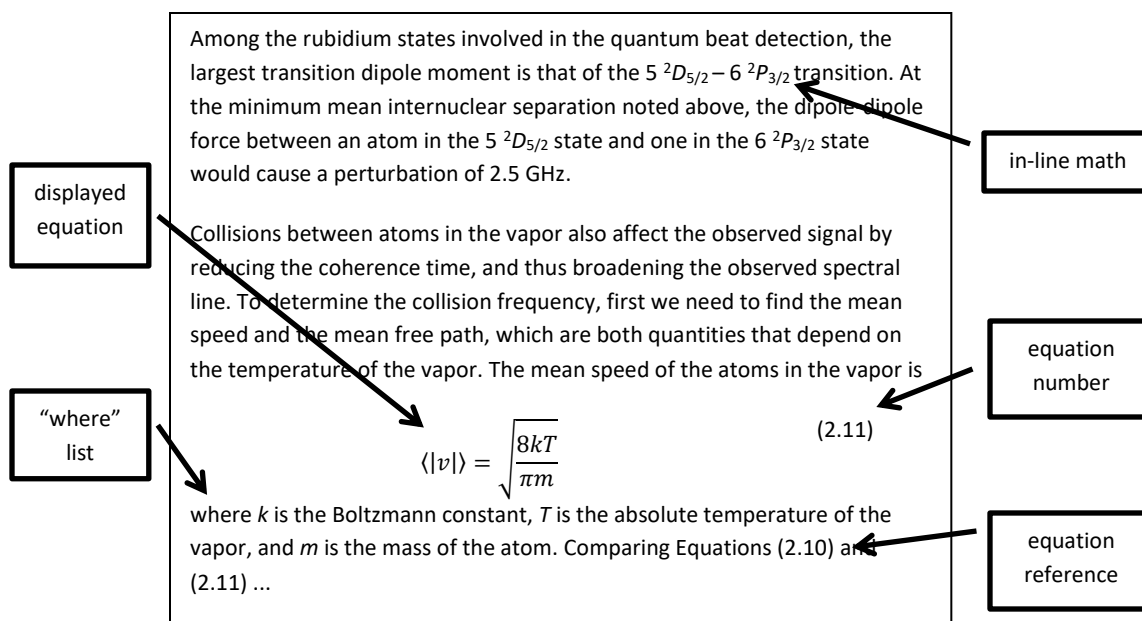


Figure 2. Well formatted passage of running text, in-line math, displayed equation with number, "where" list, and equation references.

A math symbol should be rendered with the same typography (e.g., font, italics, bold, upper/lower case) whether it occurs in display or in-line, and it should always denote the same thing. A sentence should not begin with a math symbol—especially a lowercase one, and especially when the previous sentence ends with a math symbol.

Figure 2 depicts correctly formatted math. Use the MathType extension of Word if available; if not, use symbol fonts and pay close attention to italics (for variables) and bold (for vectors and matrices). Use tables (with no borders) to keep equations and their numbers aligned. For easier reading, very long "where" lists can be formatted as ordered lists (indented and aligned).

4.4 Abbreviations

Abbreviations should be defined the first time they appear in both the abstract and the main text. After that, only the abbreviation is necessary, though you may choose to repeat the definition for a new chapter or after an extended period of disuse of the abbreviation. Many standard abbreviations are given in Appendix A. References to figures and equations may be abbreviated using "Fig." and "Eq." as long as the abbreviations are used consistently. The exception is at beginnings of sentences, where words should always be spelled out: "Equation (3.2) gives the formula for"

5. Figures and Tables

Figures and tables must be (1) neat and readable, (2) numbered with descriptive, concise captions (for figures) or titles (for tables), (3) cited directly in the text, and (4) well placed in relation to the textual discussion.

5.1 Quality

Figures should be readable within the one-inch required margins. Label axes using standard symbols for units of measure. Employ color and shading strategically to convey important distinctions, not for the sake of variety or show. Use the References ➔ Insert Caption tool to generate consistently formatted captions (always *below* the figure), and use the grouping function in Word's drawing tools to hold figure and caption together. Use picture formatting tools to hold figures in place (preferably at top or bottom of page) and to define text wraps ("top and bottom" is best).

Table titles should be short and appear *above* tables. Use Word's table design and layout tools to format titles, column heads, and borders. Align decimal points in columns so that quantities are meaningfully conveyed. Use the title and/or column heads to identify units of measure, rather than repeating them in every cell. Simplicity is best.

5.2 Numbering, Citation, and Placement

Number figures, tables, and displayed equations in *independent* sequences according to one of two systems: whole number (1, 2, 3 ...) or single-decimal (1.1, 1.2 ... 2.1, 2.2, etc., where the number to the left of the decimal corresponds to the chapter number). Use the same system for all three, but do not integrate them in one sequence. Do not create a multiple-decimal numbering system!

In the text, cite every figure and table *directly* (e.g., "Figure 1 shows ..." not "the following figure shows ..."). Citing (and numbering) equations is optional.

Pick one of three placement schemes for figures and tables and stick with it throughout the thesis:

1. Place figure or table on the page where it is first cited in text (preferably at top or bottom of page), or on the first possible page after it is cited in text (which may be some pages later if several figures are cited in a short passage).
2. Place figures and tables in a separate section at the end of the chapter.
3. Place figures and tables in a separate chapter after the conclusion and before the references.

Schemes 2 and 3 require a numbered section or chapter entitled "Figures and Tables" with a table of contents entry. When you cite the first figure or table in the text, notify the reader with a comment such as "All figures and tables are in Section X.X" or "All figures and tables are in Chapter X." Figure 3 and Table 1 provide examples of scheme 1.

Do not reserve an appendix for figures and tables, and do not create independent series of schematics, photographs, block diagrams, etc. *These are all figures*, part of one sequence of figures. If helpful, you may specify the kind of figure in the caption or textual discussion, but it is usually obvious.

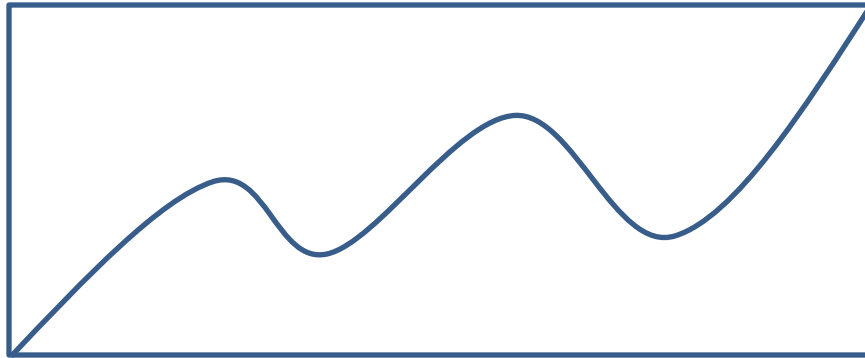


Figure 3. Figure placed according to scheme 1.

Table 1. Table placed according to scheme 1

	Electricity	Magnetism
Field intensity	E	H
Flux density	D	B
Constitutive factor	ϵ^b	μ^c

You may place figures and tables according to scheme 2 or 3 in the main text while using scheme 1 in an appendix; otherwise, however, *do not mix* the three placement schemes.

Do not scatter figures among short passages of text as if narrating a slide show. Rather, write in unified, coherent, complete paragraphs, and try to hold blocks of text together on the page. This is why top or bottom of the page is best for figure and table location.

Large figures and tables may be rotated 90 degrees counterclockwise along with the caption, but keep the page number at the bottom in “portrait” orientation. Multipage figures and tables should have a caption or title such as “Figure 1 (continued)” on every page after the first. However, never split a figure or table (including its caption or title) across a page break when it will fit in one page; for example, do not start a short table at the bottom of one page and continue it on the next.

6. Conclusion and Further Resources

Unfortunately, “ECE 499 template.dotx” will not guarantee a well-organized and formatted thesis. It certainly will not guarantee a well written one. The best way to ensure success is to start early, communicate regularly with your advisor and labmates, seek help when you get stuck, and revise, revise, revise! Use the checklist provided in Appendix B.

You can get help with the writing process, including questions of style, grammar, and organization, through the Writer’s Workshop with locations across campus including Grainger Library. See the web site at <https://writersworkshop.illinois.edu/>. (The link “Writer Resources” is extremely helpful, with a grammar handbook, ESL resources, and writing tips.)

Strunk and White [10] bears reading about once per year for anyone who must write effectively in his or her career. Williams and Bizup [11] is more lengthy but very worthwhile. For engineering writing in particular, Irish [12] is a fresh, concise, and highly readable introduction, while Alred et al. [13] provide an exhaustive overview that is useful as a reference tool.

References

- [1] *Motorola Semiconductor Data Manual*, Motorola Semiconductor Products, Inc., Phoenix, AZ, 2017.
- [2] *DDR4 SDRAM RDIMM Addendum*, datasheet, Micron Technology, Inc., 2020. Available at: <https://www.micron.com/-/media/client/global/documents/products/data-sheet/modules/rdim/DDR4/asf18c2gx72pzbz.pdf>
- [3] Linx Technologies Wireless UART RF Modules, web page. Available at: <https://linxtechnologies.com/wp/p/rf-modules/rf-modules-rf-modules/wireless-uart-rf-modules/>. Accessed Feb. 2020.
- [4] E. Nakigawa, *Lasers and Their Applications in Surface Science and Technology*, 3rd ed., Wiley, 2016.
- [5] N. Jokic and J. Murray, "NuggNET: A CNN for 2D materials defect detection and classification," in *Convolutional Neural Nets and Their Applications in Solid State Electronics Development and Testing*, W.-S. Zhou and P. D. Balasubramanian, Eds. Springer, 2018, pp. 117-132.
- [6] F. Rosolino, "TDM and TWDM de Bruijn nets and shufflenets for optical communications," *IEEE Transactions on Computers*, vol. 67, no. 6, pp. 695-701, June 2019.
- [7] S. Al Kuran, "The prospects for GaAs MESFET technology in dc-ac voltage conversion," in *Proceedings of the Twenty-first Annual Portable Design Conference*, 2017, pp. 137-142.
- [8] T. Gutierrez and J.-D. Park, "A local adaptive protocol," Argonne National Laboratory, Argonne, IL, Tech. Rep. 916-1010-BB, 2016.
- [9] J. Groeppelhaus, "Java 8.2 tutorial: Design of a full adder," class notes for ECE 290, Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 2019.
- [10] W. Strunk Jr. and E. B. White, *The Elements of Style*, 4th ed. Needham Heights, MA: Allyn & Bacon, 2000.
- [11] J. M. Williams and J. Bizup, *Style: Lessons in Clarity and Grace*, 12th ed. Pearson, 2016.
- [12] R. Irish, *Writing in Engineering: A Brief Guide*. Oxford University Press, 2015.
- [13] G. J. Alfred, C. T. Brusaw, and W. E. Oliu, *Handbook of Technical Writing*, 10th ed. St. Martin's Press, 2011.

Appendix A Recommended Abbreviations

Unit or Term	Symbol or Abbreviation	Unit or Term	Symbol or Abbreviation
alternating current	ac	electromotive force	EMF
American wire gauge	AWG	electronvolt	eV
ampere	A	electrostatic unit	ESU
ampere-hour	Ah	erg	erg
amplitude modulation	AM	extra-high voltage	EHV
angstrom	Å	extremely high frequency	EHF
antilogarithm	antilog	extremely low frequency	ELF
atomic mass unit (unified)	u	farad	F
audio frequency	AF	field-effect transistor	FET
automatic frequency control	AFC	foot	ft
automatic gain control	AGC	footlambert	FL
automatic volume control	AVC	foot per minute	ft/min
average	avg	foot per second	ft/s
backward-wave oscillator	BWO	foot-poundal	ft-pdl
bar	bar	foot pound-force	ft•lbf
barn	b	frequency modulation	FM
beat-frequency oscillator	BFO	frequency-shift keying	FSK
bel	B	gallon	gal
billion electronvolts*	BeV	gallon per minute	gal/min
binary coded decimal	BCD	gauss	G
bit	b	gigacycle per second	Gc/s
British thermal unit	Btu	gigaelectronvolt	GeV
byte	B	gigahertz	GHz
calorie	cal	gilbert	Gb
candela	cd	gram	g
candela per square foot	cd/ft ²	henry	H
candela per square meter	cd/m ²	hertz	Hz
cathode-ray oscilloscope	CRO	high frequency	HF
cathode-ray tube	CRT	high voltage	HV
centimeter	cm	horsepower	hp
centimeter-gram-second	CGS	hour	h
circular mil	cmil	inch	in
continuous wave	CW	inch per second	in/s
coulomb	C	inductance-capacitance	LC
cubic centimeter	cm ³	infrared	IR
cubic foot per minute	ft ³ /min	inside diameter	ID
cubic meter	m ³	intermediate frequency	IF
cubic meter per second	m ³ /s	joule	J
curie	Ci	joule per degree	J/deg
cycle per second	Hz	joule per kelvin	J/K
decibel	dB	kilobit per second	kb/s
decibel referred to one milliwatt	dBm	kilobyte	kB
degree Celsius	°C	kilocycle per second	kHz/s
degree Fahrenheit	°F	kiloelectronvolt	keV
degree Kelvin**	K	kilogauss	kG
degree (plane angle)	...°	kilogram	kg
degree Rankine	°R	kilogram-force	kgf
degree (temperature interval or difference)	deg	kilohertz	kHz
diameter	diam	kilohm	kΩ
direct current	dc	kilojoule	kJ
double sideband	DSB	kilometer	km
dyne	dyn	kilometer per hour	km/h
electrocardiograph	EKG	kilovar	kvar
electroencephalograph	EEG	kilovolt	kV
electromagnetic compatibility	EMC	kilovoltampere	kVA
electromagnetic unit	EMU	kilowatt	kW

*Deprecated: use gigaelectronvolt (GeV).

**Preferably called simply *kelvin*.

Unit or Term	Symbol or Abbreviation
kilowatthour	kWh
lambert	L
liter	l
liter per second	l/s
logarithm	log
logarithm, natural	ln
low frequency	LF
lumen	lm
lumen per square foot	lm/ft ²
lumen per square meter	lm/m ²
lumen per watt	lm/W
lumen-second	lm•s
lux	lx
magnetohydrodynamics	MHD
magnetomotive force	MMF
maxwell	Mx
medium frequency	MF
megacycle per second	MHz/s
megaelectronvolt	MeV
megahertz	MHz
megavolt	MV
megohm	MΩ
metal-oxide semiconductor	MOS
meter	m
microampere	μA
microfarad	μF
microgram	μg
microhenry	μH
micrometer	μm
micron†	μ
microsecond	μs
microsiemens	μS
microwatt	μW
mil	mil
mile per hour	mi/h
mile (statute)	mi
milliampere	mA
milligram	mg
millihenry	mH
milliliter	ml
millimeter	mm
millimeter of mercury, conventional	mmHg
millimicron‡	nm
millisecond	ms
millisiemens	mS
millivolt	mV
milliwatt	mW
minute (plane angle)	...'
minute (time)	min
nanoampere	nA
nanofarad	nF
nanometer	nm
nanosecond	ns
nanowatt	nW
nautical mile	nmi

†The name *micrometer* (μm) is preferred.

‡The name *nanometer* is preferred.

Unit or Term	Symbol or Abbreviation
neper	Np
newton	N
newton meter	N•m
newton per square meter	N/m ²
oersted	Oe
ohm	Ω
ounce (avoirdupois)	oz
outside diameter	OD
phase modulation	PM
picoampere	pA
picofarad	pF
picosecond	ps
picowatt	pW
pound	lb
poundal	pdl
pound-force	lbf
pound-force foot	lbf-ft
pound-force per square inch	lbf/in ²
pound per square inch§	psi
power factor	PF
private branch exchange	PBX
pulse-amplitude modulation	PAM
pulse code modulation	PCM
pulse count modulation	PCM
pulse duration modulation	PDM
pulse position modulation	PPM
pulse repetition frequency	PRF
pulse-repetition rate	PRR
pulse-time modulation	PTM
pulse-width modulation	PWM
radian	rad
radio frequency	RF
radio-frequency interference	RFI
resistance-capacitance	RC
resistance-inductance-capacitance	RLC
revolution per minute	r/min
revolution per second	r/s
roentgen	R
root-mean-square	rms
second (plane angle)	..."
second (time)	s
short wave	SW
siemens	S
signal-to-noise ratio	SNR
silicon controlled rectifier	SCR
single sideband	SSB
square foot	ft ²
square inch	in ²
square meter	m ²
square yard	yd ²
standing-wave ratio	SWR
steradian	sr
superhigh frequency	SHF
television	TV
television interference	TVI

§Although the use of the abbreviation psi is common, it is not recommended. See pound-force per square inch.

Unit or Term	Symbol or Abbreviation
tesla	T
thin-film transistor	TFT
transverse electric	TE
transverse electromagnetic	TEM
transverse magnetic	TM
traveling-wave tube	TWT
ultrahigh frequency	UHF
ultraviolet	UV
vacuum-tube voltmeter	VTVM
var	var
variable-frequency oscillator	VFO
very-high frequency	VHF
very-low frequency	VLF

Unit or Term	Symbol or Abbreviation
vestigial sideband	VSF
volt	V
voltage controlled oscillator	VCO
voltage standing-wave ratio	VSWR
voltampere	VA
volume unit	vu
watt	W
watthour	Wh
watt per steradian	W/sr
watt per steradian square meter	W/(sr•m ²)
weber	Wb
yard	yd

Appendix B Checklist for ECE Senior Thesis Authors

Note: Be sure to check even “automatic” features!

Pagination and margins

- _____ Title page unnumbered (counts as i)
- _____ Preliminary pages in lowercase roman numerals
- _____ Chapter 1 starts on Arabic p. 1; pages numbered consecutively after that; line spacing is 1.5 or 2
- _____ Minimum one-inch margin on all sides of every page (page number falls slightly outside, which is OK)

Abstract and subject keywords

- _____ On page ii
- _____ Title same style as chapter titles, but unnumbered
- _____ Presents main findings concisely and that is all
- _____ Good keywords chosen in consultation with advisor and with reference to standard taxonomy

Table of contents

Format

- _____ Preliminary material (abstract, acknowledgments) *not* included
- _____ Consistent capitalization
- _____ Leader dots appear and page numbers aligned (automatic)

Agreement with text

- _____ Wording of chapter titles and subheadings matches text exactly (automatic)
- _____ Page numbers correct (automatic)
- _____ Hit the Update tab!

Figures

Placement

- _____ Same page as first citation in text or first possible page after that
or
- _____ Separate section (with tables) at end of each chapter
or
- _____ Separate chapter (with tables) after Conclusion
- _____ **Not** scattered among short passages of text

Figures (continued)

Numbering and citations

- _____ Every figure cited directly in text (e.g., “Figure 1 shows ...”)
- _____ Figures numbered in order of their citation in text

Quality

- _____ Information conveyed economically
- _____ Neat, legible, and within margins
- _____ Axes labeled

Captions

- _____ Every figure has descriptive caption (not just “Figure 1”)
- _____ Caption below figure, use “Figure X (continued)” for multipage figures

Tables

Placement

- _____ Same page as first cited in text or first possible page after that
or
- _____ Separate section (with figures) at end of each chapter
or
- _____ Separate chapter (with figures) after Conclusion

Numbering and citations

- _____ Every table cited directly in text (e.g., “Table 1 shows ...”)
- _____ Tables numbered in order of their citation in text

Quality

- _____ Neat and legible
- _____ Decimals aligned
- _____ Column and row headers labeled, with unit symbols, if necessary

Titles

- _____ All tables have descriptive title (not just “Table 1”)
- _____ Title *above* table, use “Table X (continued)” for multipage tables

Equations

- _____ Neat and legible, with proper use of italics and bold
- _____ Centered or indented consistently
- _____ Numbered in sequence and according to same scheme (whole number or single-decimal) as figures and tables, but in a sequence independent of figures and tables
- _____ Use of parentheses both in display and in text citation
- _____ Numbers are flush right

Appendices

- _____ Appear before References *if* they contain reference citations
- _____ Figures and tables numbered, with captions/titles, and cited in the text

References

- _____ All references cited in the text, and every citation corresponds to an entry in References
- _____ Numbered in order of citation in text, OR list is alpha order
- _____ Use of brackets and other IEEE style
- _____ Use the template, and proofread!

Writing and style

- _____ Quantities expressed with number, space, and correct unit symbol
- _____ Abbreviations defined at first use and used consistently afterward
- _____ Writing is neutral in tone, formal in style, and consistent throughout the thesis
- _____ Active voice used as much as possible
- _____ Needless words omitted
- _____ Every sentence clear and readable
- _____ Read the paper aloud (you'll be surprised at what the eye can miss but the ear can catch)
- _____ Ask a labmate to read and comment
- _____ Ask a friend who is unfamiliar with the subject matter to read and comment
- _____ Run Microsoft Word spelling & grammar check (but keep your thinking cap on)