

Evaluation Form ECE 3041

Recommendation Report with Mandatory Consultation

Print clearly and legibly.

Student Name _____ GT# _____

Lab Section _____ Writing Consultant _____

Writing Assignment Number (circle one) 1st 2nd Did you attend a writing consultation? _____

Pledge of Academic Honesty: *On my honor, I pledge I have neither given anyone else assistance or information on this lab nor have I received assistance or information from anyone other than Drs. Brewer and Robinson or Instructors Laughter and Bourgeois, the UTA lab assistants, or the GTA writing consultants. I further pledge I am in full compliance with every statute and codicil of the Georgia Tech Honor Code and all of the work that appears in this report is my own, unless it is attributed to another source. I understand and agree that any violations of the Georgia Tech Honor Code will be forwarded to the Dean of Students for adjudication.*

Student's Signature _____

Date _____

Technical Writing Grading Rubric

SECTION	POINTS POSSIBLE	POINTS EARNED
Flow / Organization / Content (logical and ample flow of content; effective use of criteria; real-world logic and detailed use provided)	25	
Effective Use of Graphics (relevant, useful, cited properly, size appropriate, used enough, integrated and explained)	15	
Attended Mandatory Consultation	15	
Formatting (effective arrangement of text and graphics, use of fonts, color, bold, underline, line spacing, , etc.)	5	
Audience Appropriateness (tone; readability/ usability ; judicious use of technical terminology; relevant procedures)	10	
Technical Correctness / Clarity	10	
Homework	10	
Overall Effectiveness of Document	10	
TOTAL	100	

Note: Failure to staple this grade sheet to top of writing assignment results in a 10-point penalty.

Comments:

Grading Rubric *Recommendation Report*

Section	Points
Flow / Organization / Content	25
Effective Use of Graphics	15
Mandatory Consultation	15
Formatting	5
Audience Appropriateness	10
Technical Correctness / Clarity	10
Overall Effectiveness of Report	10
Homework	10
Total	100

Ask yourself one question about your report: Is your document better developed, more nuanced, more insightful, and more reasoned than a lab report?

Flow / Organization / Content: Does each section contain *enough* information, and is it appropriate to that section? *Have you defined and analyzed criteria effectively?* Provided and explained real-world use, as necessary? Can the reader quickly find specific information without having to read the entire document? Did you anticipate reader's questions?

Effective Use of Graphics: Have you used enough graphics? Integrated them into the text? Have you placed them so that readers don't have to "flip" through the document to find the appropriate figures? *Have you explained them well enough so the average reader can comprehend contents?* Are your graphics in proportion to the text? Have you *removed any black screenshots* and substituted them with shots that are easier on the eyes?

Mandatory Consultation: On time, with more than outline or one-page attempt at draft.

Formatting: Are your section headings in a bold, distinct font, and easy to read? Have you avoided too much "density" with your wording? Have you included subheadings?

Audience Appropriateness: Can your audience use your document as needed? Can he/she learn from it? Have you defined terms and procedures as needed?

Technical Correctness / Clarity: Are all necessary functions included and analyzed? Do you explain theory as needed? Are your results verifiable?

Overall Effectiveness: Does your document succeed in meeting the parameters of the assignment? Does it go farther than a lab report?

Homework: Did you complete your homework before lab and turn it in on time?

**3041 WA Homework Assignment for Lab
Spring, 2012**

Please note: This homework assignment is worth 10 points, as a component of your writing assignment. **In order to receive the 10 points, you must complete and print the assignment before lab.** The assignment is due the appointed lab day when I lecture. **No late homework is accepted, and any homework printed after I begin my lecture will also not be accepted.**

Come to lab prepared to share answers to these questions.

Write 1-2 complete paragraphs **in total** that incorporate all answers to these questions. The paragraphs must be typed and cohesive. Please limit your responses to no more than one page and *no less* than one-half page.

1. What is the purpose of this experiment? Be specific with your answers. The formula for a purpose statement is *What* are you doing; *Why* are you doing it; *How* are you doing it; not necessarily in that order. This statement is longer than one sentence, and does **not** begin with "The purpose of this experiment is. . . ." Take the three words *what*, *why*, and *how* to begin each phrase, and use them in any order that makes sense to you. *What* concerns what equipment and tools you are using. *How* will be a list of verbs, all the tasks of your procedures. *Why* means why you were asked to do this experiment. (Hint: the answer is not to pass the course, or to find a way for world peace. Be specific and detailed in creating this purpose statement. It will be longer than just a couple of sentences.)
2. What is meant by a notch filter? Relate it to the common English usage of the word "notch."
3. Why is it impossible to have a first-order notch filter?
4. What advantages can a passive notch filter have over an active?
5. Why is a notch filter called the 'dual' of a bandpass filter? What does each do?

**ECE 3041 Assignment Sheet:
Recommendation Report
Second-Order RLC Notch Filter Design
Spring, 2012**

<i>Length</i>	15 page maximum, 5 page minimum
<i>Point Distribution</i>	0-90 points, plus 10-point homework; regular letter grade breakpoints
<i>Lecture Date</i>	April 3, 4, 5, in lab
<i>Due Date</i>	Monday, April 23, 10 AM, my office, VL-444

You must have a hard copy of this assignment sheet and other handouts while I lecture, so print it out now; a ten-point penalty applies to anyone without printed copies. Yes, I will check.

You will be called upon during class discussion, so you must be prepared. Success with this assignment means close attention to *all* details of this assignment sheet and careful note-taking. You must review this material before you come to lecture.

Note: This assignment contains a mandatory consultation component, which takes place roughly from April 9 through April 19. I'll explain and provide you with details, plus a sign-up sheet during my lectures.

Because all 3041 students will be working toward the same goal and essentially using the same procedure for this assignment, plagiarism may rear its ugly head. *I have one word of warning: don't.* Do not ask another student, copy or share even a single word or number, fact or figure, appendix or screen capture.

All consultants will share completed assignments and cross-check to make certain no irregularities occur.

Required Formatting Instructions for 3041, 3042 Documents

Use font size of 11/12 for your text. Larger font is reserved for titles and section headers. Do not increase font size or margins to increase your document's "heft." You aren't fooling anybody.

Write in "modified block" style. Modified-block means single-spaced text in paragraphs; no indentation of new paragraphs; double space between paragraphs. This document is written in modified block style. Avoid "magazine format"; create a flush left margin and ragged right margin. Do **not** fully justify your document because extra spaces are created between words to make everything fit into a neat rectangle of text.

Integrate/Explain your graphics. Tell your reader what to look at first and what you find important in each graphic. Provide this instruction in the preceding text. It's **not** enough to state "Details found in Table 5," or "Refer to Figure 5." Pick a point, a number, a slope, a cell, and direct us to it and explain its importance. You must tell us which details are the most important by telling us to note them first.

These formatting instructions approximate what you will be using in the workplace. Now is a good time to get used to them.

Audience

You cannot begin to write any effective business document until you have examined and analyzed the needs of your audience. We will spend time discussing this critical factor. **Your audience for this report is me, your lab manager at Burdell Electronics.** You are making your recommendation based on criteria I have selected for you, and will explain. **You are one of my 'staff' engineers.** You must define and analyze these criteria, and you will then suggest a detailed application for the filter. You must tell me what you think we (Burdell Electronics) can do with this information, and how you think I should be thinking about use of these devices and your procedures.

I will examine your proficiency in the lab, your comprehension of how we can use your acquired information in our company, and your suggestions for use; you will explain how these devices fit into an idea you have for a design we can implement.

I will incorporate my perceptions of your performance and ability to put your knowledge to work for us in your annual employee review, which is typical of what goes on everyday in business.

However, you will not need to pad your reports with unneeded theory or clutter. Stay focused on relevant details only. Your objective is to get this assignment completed at around 15 pages.

Think of writing your report this way: Your attention to detail in the lab matters, but what you think about this work and **how** you think we can use this information is crucial to both our success as a company, and your success as a rising manager.

Procedures

Please refer to the separate Procedures list.

Recommendation v. Feasibility Reports

Recommendation reports, like feasibility reports, present a position based on hard evidence supported by facts. A simple way to remember the difference between the two types of reports is feasibility reports take up the issue of whether an action *should* or *could* take place, such as expanding and redesigning a conference room in your business. A recommendation report helps make the decision about what or where or how to complete the task by *comparing* and *contrasting* two or more ideas for its execution. For example, a recommendation report helps decide the debate of whether to remodel the existing space for the conference room or create a new space for the room in another part of the building. By using specific, uniform criteria, recommendation reports inform the reader about which procedure or equipment to choose and why.

Purpose of Recommendation Reports

Why would engineers perform these measurements in the first place? Why would these criteria matter? The criteria for laboratory recommendations about procedure and equipment usually fall into three categories: technical, managerial, and cost. Your recommendation report will be concerned with certain types of usefulness defined by your examination of typical customer use, and it might be informed by the idea of cost. The report must contain the required four sections: Introduction, Analysis/Criteria and Comparison, Conclusions, Recommendation. You must also include as much illustration as you deem necessary to convince your reader and establish credibility. Make no claims without proven facts. Provide any information you consider relevant and important.

Organization

These documents also make use of defined sections that follow a reader's cognitive process in exploring and comparing the available choices. The writer anticipates the reader's questions and even the order in which the questions come up, prioritizes the report sections, "chunks" the information, and interprets the facts accordingly. All claims are supported by data. The sections of these documents are written in a specific order because that is the order in which a decision-maker might think. Simply put, nothing random or arbitrary exists in these reports. They are streamlined and task-oriented; nothing is wasted.

Audience

Recommendation reports are often written for a multiple, or 'mixed' audience, and usually for an audience without all of your technical expertise. Many people might read these reports, with varying degrees of knowledge about the process or product. Writers should not rely heavily upon jargon or technical terms before first analyzing the audience. Remember who will read this report. Why will it be read? What is your reader's level of expertise? The average reader should find the report logically organized, easy to search and read, thorough and on-topic, and self-contained.

Even if you write for your lab manager, don't assume that person will be as technically proficient or as up-to-date as you, when it comes to procedures and application. Explanation will be necessary from time to time.

Recommendation reports are written usually by the actual users of the equipment or a person contracted or assigned to analyze a procedure. Often, that means, you, the engineer must write these documents. Since you are the technical expert, you may also need to write the manual or report, anticipate any questions and problems, and take up or assist with the decision-making process.

Components of Recommendation Reports

Introduction

The first section of the recommendation report is the *Introduction*. This important section

- contains a background statement (minimum 1-2 sentences),
- identifies the problem or issue (minimum 1-3 sentences),
- states the criteria, and method of investigation, for comparison (1-2 sentences),
- concludes with your recommendation (1 sentence).

The three-part purpose statement we will discuss informs and provides some of the motivation for your Introduction. **The Purpose Statement has three components: what you are doing; why you are doing it; how you are doing it.** You must be detailed and specific with this statement.

The Introduction introduces *everything* that is detailed within the report and reveals the purpose and also explains the need for the recommendation and your final decision. You will be stating what you are doing, why you are doing it, and how you are doing it; not necessarily in that order. The Introduction is written so your reader can find out with a quick read how you defined the problem, what you used as comparison, and what your conclusion and recommendations are. As the first section in the report, it provides **all** important information for those readers who may not be able or interested in reading the report in its entirety.

Begin with a background sentence such as “With an increasing mobile and remote work climate utilized by companies around the globe, the most valuable work tool is the portable laptop. To make the best decision about which laptop computer to buy, three criteria were established.” The report would go on to compare four computers, so with the first and second sentences the writer has established the purpose of the report without overtly stating it, set the scene, and is on the way to establishing credibility with the reader.

Analysis/Criteria and Comparison

The second section of a recommendation report is *Analysis*, or *Criteria and Comparison*. A compound section, here is where the writer

- defines and ranks criteria for comparison
- states why these criteria were selected
- shows how they compare
- uses graphics to illustrate comparisons

To “analyze” means to break down into parts, and this section begins with the writer using professional expertise and the information available about the needs and alternatives in the situation. *Criteria usually are technical, managerial/maintenance, financial, or a variation of these three.* **Define the criterion, rank it in importance, if needed, and apply it.** Use charts, graphs, tables, illustrations, such as cost projections, blueprints, panel layouts, or screen captures, as needed within the section. Show all work. *Make certain your reader understands why you chose these criteria.* The explanation of your criteria and why you chose it should include at least a full paragraph of rationale.

Comparison or application, which follows the listing of criteria, can be done two ways: Either point-by-point, or procedure-to-procedure. Take a criterion, and apply to *each* product or procedure, compare, analyze, and then move to the next, or analyze all criteria for a procedure at once, and then compare the criteria of the next procedure. The Analysis section usually also has subheadings, since the reader must first define the criteria, and examine them, and then proceed to compare and contrast. Be sure you complete your comparisons and that they are clear and logically consistent. These two methods of criteria usage are outlined below:

Point-by-Point Comparison

Criterion A

Procedure-to-Procedure Comparison

Procedure 1

Procedure 1
Procedure 2
Criterion B
Procedure 1
Procedure 2

Criterion A
Criterion B
Procedure 2
Criterion A
Criterion B

Conclusions

The third section of the report is *Conclusions*, usually two to three paragraphs in length. Here, the writer will

- interpret findings
- provide rationale for choice or decision
- use sequential or simple listing for illustration

Conclusions will be a relatively easy section to write because the writer simply interprets all data and findings and prepares the reader for the final section.

Recommendation

Recommendation is the last section, usually three to eight sentences. Here, the writer explicitly states which option is best and provides a brief rationale. It is a lean section because all the analysis has been done in the first three sections. Please remember, though, this section is the last the reader will encounter. You might want to detail your suggested application here. Just because Recommendation is brief does not mean you should just stop writing. Use your rationale and your hard work to state what you think. Do not be timid. End with strength. Remember the scenario.

Details of Report Writing

The most important feature of an effective recommendation report is its “user-friendliness,” the ease in which a reader can access information and comparisons. The audience must be uppermost in the writer’s mind when establishing, analyzing, and comparing criteria. As in many technical documents, the following components are likely elements of recommendation and feasibility reports:

- Easy-to-read sections that incorporate devices such as headings, subheadings, page numbers, appendices or indexes, and citations.
- Diagrams, photos, screen captures, charts, tables, and figures that help the reader comprehend the comparison and become more familiar with the procedure or equipment. **No “black” screenshots.**
- Page designs that effectively lay out the information with clear labeling, “chunking,” and white space. “Chunking” simply means grouping things together, breaking information into manageable units easy for the reader to find and use. Bulleting, numbering, and indenting information/steps/tasks are good ways of “chunking.”
- Consistent, clear use of terminology that keeps the reader focused.
- Simple, economical style providing the reader with only what is needed; no fluff, nothing extraneous.

Think about accessibility and functionality of your document in the same way you might think about a piece of engineering equipment: Is it easy to comprehend? Can the average user (reader) follow the instructions, understand your rationale, and attain usage goals? Do you anticipate the requirements, both visual and cognitive, of your reader?

Effective technical documents complete their assigned tasks by anticipating the needs of their audience and following a logical and easy to read format. Avoid dense text, too much narrative, condescending “tone,” out-of-proportion graphics, or illustrations too complicated for your average reader. Think about flow of ideas and ease of comprehension. Do not forget your audience, but make no assumptions other than their computer abilities. Make every word, diagram, and bit of white space work for your reader. Everything counts.

Your report should make liberal use of well-integrated graphics, including, but not limited to, screen captures and illustrations. You are allowed to use illustrations obtained from websites and/or Dr. Brewer’s lab manual. You must explain what you wish the reader to see first, in order to have effective integration of your graphics.

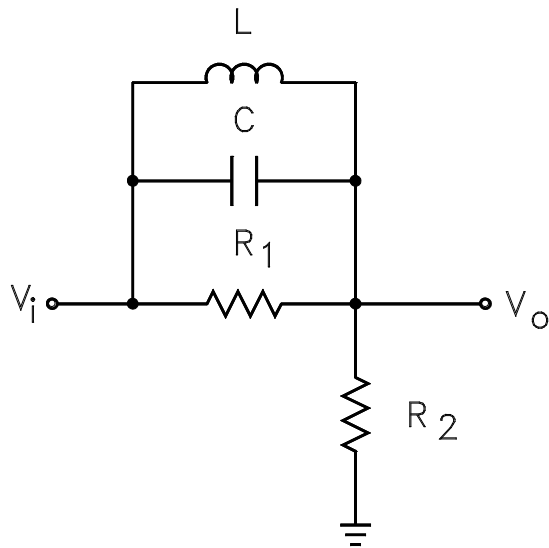
Your recommendation report must include the four required sections and follow the guidelines we will discuss in lab. You will be evaluated on how well you analyze your criteria and evidence, how well you ground your argument in fact, how you think our company can use your experimental findings, and how “user-friendly” your report is.

Second-Order RLC Notch Filter Design

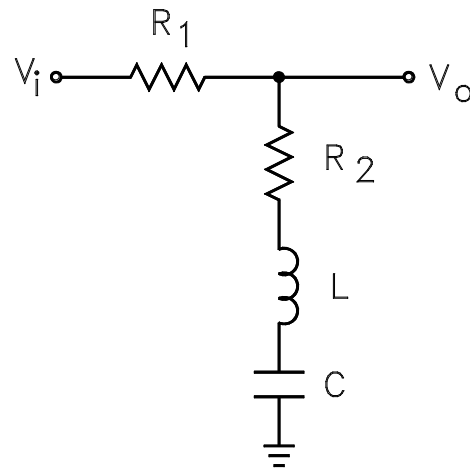
Task: To design a second-order RLC notch filter. To compare the measured results with SPICE simulations and Mathcad calculations and recommend which of two circuits should be used, and detail an idea for specific application. Ideally, a notch filter removes a single frequency or small band. Your suggested, detailed application will be based on that principle.

Theory:

The circuits shown below are second-order finite notch RLC filters. The input is V_i and the output is V_o . At low frequencies the capacitor has a large impedance while the inductor has a small impedance. Consequently at low frequencies the output and input are approximately the same for both circuits. At high frequencies the roles reverse and the inductor has a large impedance while the capacitor has a small impedance, which also makes the input and output voltages essentially the same.



Parallel Finite Notch



Series Finite Notch

However, at the resonant frequency $f_o = \frac{1}{2\pi\sqrt{LC}}$ the inductive and capacitive reactance are equal in magnitude and opposite in sign, which makes the circuit purely resistive at this frequency with respect to the input terminals and the transfer function becomes

$$T(f_o) = \frac{R_2}{R_1 + R_2}$$

at resonance for both filters. The depth of the notch in decibels is given by
 $-20\log_{10}[T(f_o)]$

which is simply the negative of the gain in decibels. If R_1 is zero for the parallel circuit or R_2 is zero for the series circuit the output of the circuit is zero at resonance and the depth of the notch is infinity.

The complex transfer function is given by

$$T(s) = K \frac{\left(\frac{s}{\omega_o}\right)^2 + \frac{1}{Q_N \omega_o} s + 1}{\left(\frac{s}{\omega_o}\right)^2 + \frac{1}{Q} s + 1}$$

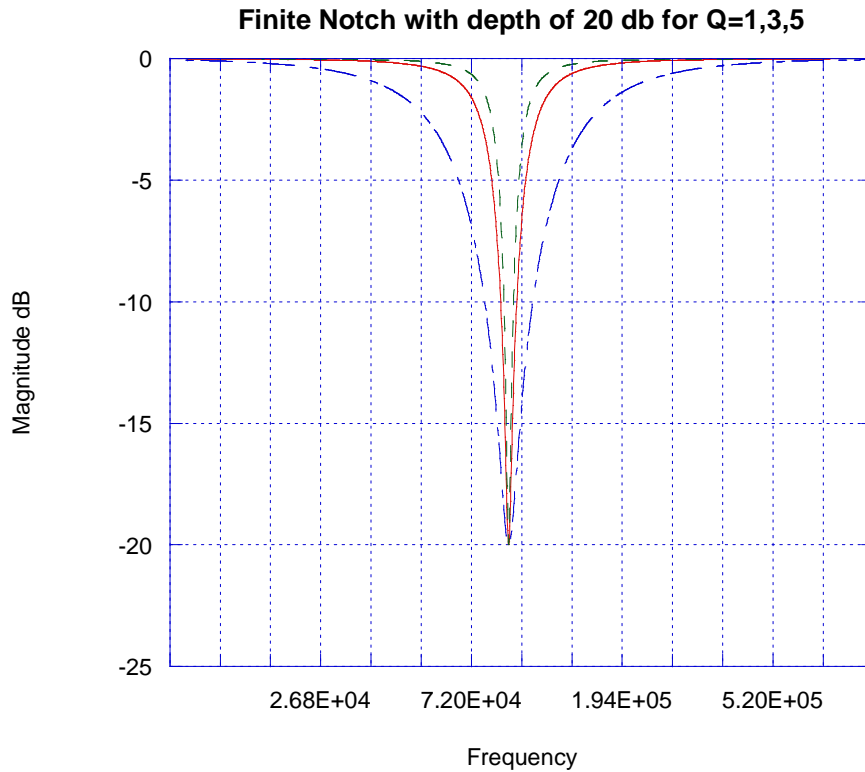
Where $K=1$, $\omega_o = 2\pi f_o$, and $f_o = \frac{1}{2\pi\sqrt{LC}}$ for both the series and parallel filters.

For the series case $Q = \frac{\omega_o L}{R}$ and $Q_N = \frac{\omega_o L}{R_N}$ where $R = R_1 + R_2$ and $R_N = R_2$. For the

parallel case $Q = \frac{\omega_o C}{G}$, $Q_N = \frac{\omega_o C}{G_N}$, $G = \frac{1}{R}$, $G_N = \frac{1}{R_N}$, $R = R_1 \parallel R_2$, and $R_N = R_1$.

Shown below is a plot of the magnitude of $T(f)$ in decibels as a function of f for various values of Q and a notch depth of 20 dB for $L=3\text{mH}$ and $C=1\text{nF}$. The higher the Q the

more narrow the plot is centered about the resonance frequency.



Procedure:

- The inductor that will be used in this design assignment is the one that comes in the ECE 3041 parts kit, which has a nominal value of 3 mH. Use the Fluke/Philips RCL meter to measure and record the actual value of the inductance and its series resistance.
- The nominal value of the capacitor will be determined by the last digit of the experimenter’s GTID no. Namely, select C as

GTID	C	GTID	C	GTID	C
0	1nF	3	3.3nF	6	10nF
1	1.5nF	4	4.7nF	7	15nF
2	2.2nF	5	6.8nF	8	22nF
				9	33nF

- Measure and record the actual value of the capacitance and its parallel resistance with the Philips/Fluke RCL meter.
- Use the measured values of the inductance and capacitance to compute the resonance frequency.
- Design a second-order RLC finite notch filter with the notch frequency yielded in the previous step, a Q and a notch depth specified below. The Q is determined by the next to last digit of the GTID no and the depth of the notch in decibels by the third to the last digit of the GTID no.

GTID	Q	GTID	Q	GTID	Q
0	5	3	3.5	6	3.75
1	4.5	4	4.75	7	4.2
2	4	5	4.25	8	4.8
				9	3.85
GTID	Depth(dB)	GTID	Depth(dB)	GTID	Depth(dB)
0	20	3	17	6	14
1	19	4	16	7	13
2	18	5	15	8	12
				9	11

- Use the nearest standard values of R to implement the design. Perform the design for both the series and parallel forms of the circuit.
- Use the laboratory equipment to plot the magnitude of the complex transfer function in dB as a function of the frequency of the source as the frequency of the source varies from one decade below the notch frequency to one decade above. Use enough points to obtain a smooth curve. Note that since the width of the notch is somewhat small it may be necessary to use more data points than normal.

Report:

The report should include

- All the measured data and plots obtained.
- A SPICE simulation of each filter, using the measured values of the circuit components. Plot both the magnitude in decibels and the phase in degrees.
- A plot of the magnitude and phase of the complex transfer functions for each of filters using Mathcad.
- An explanation of any anomalies.

In later courses electronic filters of both the digital and analog flavor will be studied. Discuss advantages this passive RLC filter has over electronic filters.

Discuss the effect of the use of non ideal components on the response of these filters.

Discuss any effect instrumentation loading may have had on the experimental results.

Was the design a success? How could it be improved? What can Burdell Electronics use it for? Be specific with your suggested application.

How do these filters differ from RC filters?