Proof of Concepts

Download and modify this template for your PoC assignment. Delete this introductory description before submitting. Answer all questions in black, bold text. Answers should be short and to the point (see example). More writing is not necessarily better. Some simple examples are given in red text.

Unlike in Alpha Labs, the Omega Labs Proof of Concepts assignment is not to ‘Prove the Concepts.’ Instead, you will use concepts learned in class to design your circuit. Generally, you will use a concept to choose a component value. You will then simulate and measure one or more circuit variables (voltage, current, etc.) to verify that your choice of component value or design choice operates as intended and corresponds to your analytical predictions.

# Things to Consider…

* Word has an equation editor you can access by pressing Alt+’=’. Google drive has an equation editor through Insert > Equation. These editors have lots of nice short cuts, like:
	+ **Special Characters**: \alpha turns into $α$ (applicable to other Greek letters and special characters)
	+ **Subscript**: A\_0 turns into $A\_{0}$
	+ **Superscript**: A^0 turns into $A^{0}$
	+ **Fraction**: A/(B+C) turns into $\frac{A}{B+C}$
	+ And more…
* Make sure your LTSpice schematics are neat and legible. You can draw shapes and lines in LTSpice by navigating to Edit > Draw. You can print a schematic to a pdf by printing the file to PDF.
* Use [net labels](http://ltwiki.org/index.php?title=Label_a_node_name) to declutter your LTSpice schematics.
* Your plots can be from LTSpice or measurements

Please, keep the document short! More does not mean better. Use tables, equations, and plots to concisely explain your circuit. Don’t show derivations in the body of the report, and don’t do calculations in the text of a paragraph.

### NAMES of GROUP MEMBERS

For each Proof of Concepts deadline, choose 2 Concepts from the corresponding Milestone to analyze.

# Concept Name 1

## Description

**What building block are you applying this concept to?**

LED

**What circuit variable(s) will be derived in analysis? Briefly (1 or 2 sentences) describe how you will apply the concept to derive the variable.**

We will use Ohm’s Law to derive the resistance we need to obtain 5mA for a 5V source.

**Paste a well-formatted schematic of the circuit you are analyzing, and include only this circuit and not any others. Label all important nodes; Any nodes or components you discuss in your analysis section should correspond to a labelled node in the schematic.**

## Analysis

**Write the general, symbolic equation(s) you are using to perform your calculation. Please show any lengthy derivations in the appendix to improve readability. Ensure that all variables used in the equation are defined either by labelling them in the schematic or defining them in-text.**

**Calculate a numerical value for your circuit variable(s).**

We calculated that we need a 1kOhm resistor to obtain 5mA.

**State what circuit variable(s) you will measure in your simulation and experimental section to compare with your analysis and confirm intended operation of your circuit.**

We will measure the current through the 1kOhm resistor to confirm that we actually obtain 1mA.

## Simulation

Make sure that your circuit is simulated in isolation (not connected to any other circuits).

**Describe your simulation in 1 to 2 sentences.**

**If your simulation schematic differs from your schematic in the description, include it here. Make sure you include all simulation commands (e.g., ‘.tran 1m.’).**

**Place your simulation results here. This can be a plot, a numerical value, or a table. Make sure your data is formatted well and easy to read. Include all axes on plots and make sure it is clear what value is being measured.**

## Experimental

Make sure that your circuit is measured in isolation (not connected to any other circuits).

**Describe your measurement in 1 to 3 sentences. Describe any differences between your analysis/simulation and your experimental circuit. List the part numbers of any components you used outside of passive components (R,L,C), for example which op amp you used.**

We placed a relatively small 10 Ohm resistor in series with out 1kOhm resistor. We measured the current by measuring the voltage across the 10 Ohm resistor and dividing by the resistance.

**Place your simulation results here. This can be a plot, a numerical value, or a table. Make sure your data is formatted well and easy to read. Include all axes on plots and make sure it is clear what value is being measured.**

## Discussion

Here we interpret out results. If your predicted, simulated, and experimental don’t line up, consider re-evaluating your calculations, simulation setup, and experimental setup. Consider possible non-idealities present in components. Make sure you are quantitatively comparing results rather than qualitatively comparing. That is, instead of saying, ‘the results look about the same,’ calculate a percent error.

**Compare your analytical, simulation, and experimental results. Discuss any differences between them. If there is any difference between calc, sim, and measurement provide a reason as to why (DO NOT say it is from ’human error’ or ‘incorrect wiring’).**

**Discuss how this analysis helped you in your design.**

# Concept Name 2

## Description

**What building block are you applying this concept to?**

**What circuit variable(s) will be derived in analysis? Briefly (1 or 2 sentences) describe how you will apply the concept to derive the variable.**

**Paste a well-formatted schematic of the circuit you are analyzing, and include only this circuit and not any others. Label all important nodes; Any nodes or components you discuss in your analysis section should correspond to a labelled node in the schematic.**

## Analysis

**Write the general, symbolic equation(s) you are using to perform your calculation. Please show any lengthy derivations in the appendix to improve readability. Ensure that all variables used in the equation are defined either by labelling them in the schematic or defining them in-text.**

**Calculate a numerical value for your circuit variable(s).**

**State what circuit variable(s) you will measure in your simulation and experimental section to compare with your analysis and confirm intended operation of your circuit.**

## Simulation

Make sure that your circuit is simulated in isolation (not connected to any other circuits).

**Describe your simulation in 1 to 2 sentences.**

**If your simulation schematic differs from your schematic in the description, include it here. Make sure you include all simulation commands (e.g., ‘.tran 1m.’).**

**Place your simulation results here. This can be a plot, a numerical value, or a table. Make sure your data is formatted well and easy to read. Include all axes on plots and make sure it is clear what value is being measured.**

## Experimental

Make sure that your circuit is measured in isolation (not connected to any other circuits).

**Describe your measurement in 1 to 3 sentences. Describe any differences between your analysis/simulation and your experimental circuit. List the part numbers of any components you used outside of passive components (R,L,C), for example which op amp you used.**

**Place your simulation results here. This can be a plot, a numerical value, or a table. Make sure your data is formatted well and easy to read. Include all axes on plots and make sure it is clear what value is being measured.**

## Discussion

Here we interpret out results. If your predicted, simulated, and experimental don’t line up, consider re-evaluating your calculations, simulation setup, and experimental setup. Consider possible non-idealities present in components. Make sure you are quantitatively comparing results rather than qualitatively comparing. That is, instead of saying, ‘the results look about the same,’ calculate a percent error.

**Compare your analytical, simulation, and experimental results. Discuss any differences between them. If there is any difference between calc, sim, and measurement provide a reason as to why (DO NOT say it is from ’human error’ or ‘incorrect wiring’).**

**Discuss how this analysis helped you in your design.**

# Appendix

If necessary, place this at the very end of your Proof of Concepts. Any hand calculations or derivations you want to include in your report should be placed here. Provide a header name for the concept to which they correspond.

## Concept Name

Include: Analysis corresponding to concept.