

# Alpha/Omega Lab Project Plan

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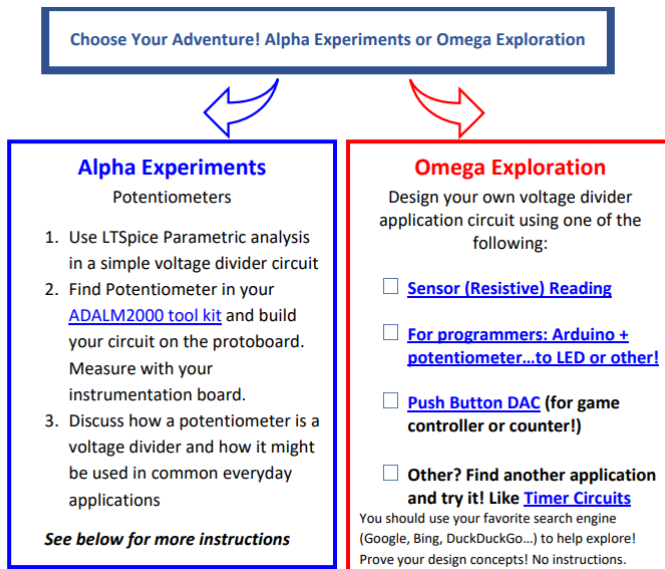
This is a guideline to help you and your supporting instructors, TAs, and SAs determine if your project is well-defined and feasible. You must fill this today and submit to Gradescope by Monday. YOU WILL BE ASKED TO ITERATE and resubmit at least two more times this semester. You CAN CHANGE YOUR PLAN. It’s part of the process of learning. It will get better. See the example Project Plan below for more details on what is expected. [This document](#) is the general overview of what is expected for your lab submissions.

# Choosing Lab Type

	Do you plan to do an Alpha Experiment?	Do you plan to do an Omega Exploration?
	Write Yes or No below if you intend to do the guided design project at the end of each lab	Write idea from the less guided exploration list OR write your own project idea below (note: your idea must relate to concepts in the lab!)
<a href="#">Lab01: Basic Analysis and Engineering Practices</a> <a href="#">Link to first class day videos background</a>		
<a href="#">Lab02 Part A: Linear Systems and Beyond...</a> <a href="#">Link to first class day videos and background</a>		
<a href="#">Lab03: The Signals and the Noise</a> (and Making Music) Coming soon!		

## Background on YOUR Lab Adventure

### Lab 01 Choose Your Adventure! Voltage Divider Applications and Design Background



# Lab 02 Choose Your Adventure! Applications: Transfer Functions, Linear Algebra, and Control

Choose Your Adventure! Alpha Experiments or Omega Exploration

## Alpha Experiments

### Sensors and Decisions

Choose an application of interest like a moisture sensor for an automated aquaponic system or a motion sensor for a smart traffic light.

1. Draw a high-level block diagram.
2. Simulate your application (must include at least one sensor and one op amp): You may simulate a sensor using a potentiometer find one in your kit!
3. Calculate the relationship from input to output for each part of your circuit. i.e. a non-inverting amplifier would amplify an input voltage by  $(1+R_f/R_g)$  to get an output voltage. This is a transfer function!
3. Build your application (using hardware) and demonstrate its function. Compare.

## Omega Exploration

Explore linear and non-linear concepts in an ECSE sub-discipline you are interested in!

- Design a sensor system for your application and create a circuit that makes a decision and triggers an alarm (light a diode or turn on a speaker). Find, simulate, build and discuss *at least one additional design* to do the same function and compare their performance! i.e. op amp vs. transistor, digital gate vs. analog, PWM vs. DC or sinusoidal...
- [Explore an Op Amp data sheet](#) and apply to YOUR design with knowledge from the data sheet. Why one Op Amp over another for your application?
- Explore how to make a diode, explain how it works (schedule clean room tour/visit) [link coming soon!](#)
- Linear Algebra and Computer Imaging [link coming soon!](#)
- [PID controller \(MATLAB Simulink -> Op amps\)](#) how would you do it?

# Lab 03 Choose Your Adventure! Music to MY ears: Filters and Signal Processing

Choose Your Adventure! Alpha Experiments or Omega Exploration

## Alpha Experiments

### Everyday Signals, Music, and Filters

Test out the filter response Signal Viewer and Audio Player (created by Prof. Rich Radke!) to see how an IDEAL filter works and how common, everyday signals are made. [Video of Prof. Radke explanation/playing with it](#) Link to player for MATLAB coming soon!!!!

1. Find and isolate frequencies in a common everyday sound [slike dialtone](#) or number for your phone.
2. Recreate this sound using Simulink by combining frequencies and play through your computer.
3. Can you make a song or specific note? Identify the note and show the overtones.
4. Use your Favorite Song and isolate frequency ranges to modify it in some way.
5. Review ANY portion of the mathematical description in Prof. Radke's video. Find a term you don't fully understand that would help you create signals and music. Identify ECSE courses that will help you understand it!
6. Build your application (using hardware M1K board, op amps!) and demonstrate its function. Compare.

## Omega Exploration

Explore how you can generate signals, eliminate noise, make music, or modify music!

- Find the hidden message in [this noisy signal!](#) Use Simulink or Build a Circuit that can filter out the noise. Example from a [Beta lab in Electric Circuits](#) Spring 2016 using Analog Discovery Board to get you started...
- Modify YOUR favorite song using filters. See what happens to your song when you isolate or remove certain frequency ranges. [link coming soon!](#)
- Generate a series of tones or create music. Add signals together to generate sounds. Use Simulink and/or build in hardware.

9/15/2022  
Troy, New York, USA

# Important Details for your Plan

## Trainings, Visits, and Access to Labs

Please check all of the trainings or visits or access you think you need if you are doing Omega Explorations:

<input checked="" type="checkbox"/>	Training, Visits, and Access	Purpose for your Project
<input type="checkbox"/>	I plan to use the Mercer Lab, I need access.	
<input type="checkbox"/>	I plan to use the Forge for 3D printing.	
<input type="checkbox"/>	I plan to schedule a visit for the clean room as an Omega Exploration for Lab02.	
<input type="checkbox"/>	I want to learn how to design a Printed Circuit Board ( <a href="#">Altium - Free enrollment</a> ).	
<input type="checkbox"/>		
<input type="checkbox"/>		

## Goals and Objectives

*Outline your goals, team member roles, deadlines for at least Lab01. Try to fill out as much as you can for the other Labs so the TA can give you advice.*

Lab 01 (Date:            )

Lab 02 (Date:            )

Lab 03 (Date:            )

Reason for update (if applicable)

## Parts List

***List an expected number of parts you will need that are not in your circuits kit. List the cost of parts you want to purchase.***

What potential issues do you foresee with this design?

What skills and concepts do you need to learn to do this?

What is your plan if this design does not work?

## TA/SA/STUDENT “Is this plan right?” Checklist

A TA must check each of these items to pass the plan. Be prepared to answer each of these questions with justification.

- Can the project be completed in the given time?
- Do the Goals and Objectives provide a reasonable pace for the project?
- Does the project align well with the learning objectives of the course?
- Is the circuit size and cost reasonable?

**Team Signatures (online by Gradescope not physical)**

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**TA Signature**

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# Project Plan Example

This is a guideline to help you and your TA determine if your project is well-defined and feasible. You must fill this out anytime you want to change your project and at the beginning of each Milestone period. **You only need to cover your plan for the upcoming Milestone** but try to plan as far as possible. This will help the TA and Professor give you feedback on how to adjust your project to be more manageable and give advice on how to implement certain parts.

## Choosing Lab Type

	<b>Do you plan to do an Alpha Experiment?</b>	<b>Do you plan to do an Omega Exploration?</b>
	Write Yes or No below if you intend to do the guided design project at the end of each lab	Write idea from the less guided exploration list OR write your own project idea below (note: your idea must relate to concepts in the lab!)
<a href="#">Lab01: Basic Analysis and Engineering Practices</a> <a href="#">Link to first class day videos background</a>	No	<b>Sensor (Resistive) Reading</b> Water Quality (Dissolved Oxygen Sensor but modeled by a potentiometer)
<a href="#">Lab02 Part A: Linear Systems and Beyond...</a> <a href="#">Link to first class day videos and background</a>	YES	
<a href="#">Lab03: The Signals and the Noise</a> (and Making Music) Coming soon!	No	<b>Modify YOUR favorite song using filters</b> I will learn how to recreate Kanye's STEM Player

## Trainings, Visits, and Access to Labs

Please check all of the trainings or visits or access you think you need if you are doing Omega Explorations:

<input checked="" type="checkbox"/>	Training, Visits, and Access	Purpose for your Project
<input checked="" type="checkbox"/>	<b>I plan to use the Mercer Lab, I need access.</b>	I may need to view high frequency signals and use a spectrum analyzer. I also want to use professional grade equipment and compare to our boards!
<input type="checkbox"/>	<b>I plan to use the Forge for 3D printing.</b>	
<input checked="" type="checkbox"/>	<b>I plan to schedule a visit for the clean room as an Omega Exploration for Lab02.</b>	It's not directly related since I'm doing alpha but I am interested in seeing this!

## Goals and Objectives

*Outline your goals, team member roles, deadlines for at least Lab01. Try to fill out as much as you can for the other Labs so the TA can give you advice.*

**Lab 01** (Date: Sept 28<sup>th</sup> deadline for submission)

Part A:

Steph: Simulations for Concepts 1,2, Analysis for 3,4, Build/Measure for 5

Draymond: Simulations for Concepts 3,4, Analysis for 5, Build/Measure for 1,2

Cassius: Simulations for Concepts Simulations for Concept 5, Analysis for 12, Build/Measure 3,4

All: Make write, clearly label in PowerPoint if needed, finish first draft using template

Update Proof of Skills if above is better than previous submissions

Part B:

***“Simulate” Dissolved O2 sensor with potentiometer***

Steph: Learn how to use potentiometer (see end of Lab01)

Steph: Figure out how to read sensor using potentiometer

Cassius: Sketch of idea/circuit...reference online information

Cassius: Simulation of idea

Draymond: Figure out voltage divider vs. wheatstone bridge

Draymond: Build and troubleshoot

All: Finish write up, clearly label in PowerPoint if needed submit

**Lab 02** (Date: November 9<sup>th</sup> deadline for submission)

**Repeat task roles for all Parts.**

**Part A**

**Part B**

**Part C**

**Alpha Lab Part D...maybe still visit clean room?...looks cool.**

**Virtual reality body glove, flex sensors**

All: Draw high level block diagram in class, Steph check with TA

Steph: Research each block for circuits we can use..op amp, flex sensor, amplifier etc.



Draymond: Simulate in LTSpice

Cassius: Build and Measure

All: Compare and comment on proving sensor decision circuit...transfer functions? Research what that is!

**November 3<sup>rd</sup> send iterations from Lab01**

**Lab 03** (Date: December 10<sup>th</sup> deadline for submission and all iterations)

**Lab not out yet...keep task roles for all parts when coming out**

Reason for update (if applicable)

## Parts List

***List an expected number of parts you will need that are not in your circuits kit. List the cost of parts you want to purchase.***

None, we'll use what's in our kits

**What potential issues do you foresee with this design?**

Time. Draymond keeps arguing with everyone and is a bit pushy which I guess is good.

**What skills and concepts do you need to learn to do this?**

All of them.

**What is your plan if this design does not work?**

Troubleshoot and redesign.

Ask TAs for help

## TA/SA/STUDENT “Is this plan right?” Checklist

A TA must check each of these items to pass the plan. Be prepared to answer each of these questions with justification.

- Can the project be completed in the given time?
- Do the Goals and Objectives provide a reasonable pace for the project?
- Does the project align well with the learning objectives of the course?

Is the circuit size and cost reasonable?

**Team Signatures (online by Gradescope not physical)**

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**TA Signature**

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