Learning objectives for lectures in EAS 199A

1 Introduction, Ohm's Law
Know how to contact instructors: email, telephone, office hours
Understand the goals and expectations of the class
Be able to explain the mechanism for conduction of electricity in solids
Be able to read data from the Periodic Table of elements
Be able to define current in terms of electron flows (in number and direction)
Be able apply Ohm's law to the prediction of voltage, current and resistance in simple DC circuits.
Understand the homework format

2 Power consumption in resistors. Resistors in series and parallel.
Be able to compute the power dissipation (or consumption or use) when current flows through serial and parallel combinations of resistors.
Be able to compute the equivalent resistance for two resistors in series.
Be able to compute the equivalent resistance for two resistors in parallel.

3 Multimeter Demo, Breadboarding an LED Circuit, Resistor Color Codes
Be able to use your multimeter to measure voltage and resistance
Be able to build circuits of resistors on the breadboard from the Sparkfun Inventor's Kit
Be able to write an Arduino program to make an LED blink

4 Kirchoff's Voltage Law, Breadboard circuits
Be able to use your multimeter to measure voltage drops around a circuit
Be able to compare predicted and measured voltages for simple resistor circuits
Be able to define and create a voltage divider on a breadboard

5 Arduino Programming, Kirchoff's Current Law, Binary Numbers
Be able to describe the role of the `setup` and `loop` functions in an Arduino sketch
Be able to list at least two Arduino variable types and describe the kinds of data they can store
Be able to convert from binary to decimal and decimal to binary number formats
Be able to predict current flow into junctions for simple resistor circuits
Be able to find the programming reference on the main Arduino we site
Be able to write Arduino programs to control the micro servo motor in the Experimenter's kit

6 Review of DC circuit analysis, Arduino programming
Be able to analyze and compute the power dissipated by any resistor in an arbitrary combination of series and parallel resistors
Be able to explain the differences between `int` and `float` variable types in an Arduino sketch
Be able to choose `int` or `float` appropriate for a coding task
Be able to write `for` loops in an Arduino sketch
Be able to write a `for` loop to compute the average of analog input measurements in an Arduino sketch

7 Plotting in Excel, Desktop Fan Introduction, Breathing LED
Be able to set up a spreadsheet in Excel that is organized and easy to read
Be able to construct a plot in Excel
Be able to describe the main steps in constructing the desktop fan project
Be able to derive the coefficients of, and evaluate the v(t) curve that describes a breathing LED.

8 Breathing LED
Be able to derive the coefficients of, and evaluate the v(t) curve that describes a breathing LED.

Be able to use PWM to control the brightness of an LED
Be able to implement codes to simulate a breathing LED with straight line segments

9 DC Motor control, Soldering the DC motor leads
Be able to safely solder extension leads onto the DC motor
Be able to use a potentiometer to control the speed of the DC motor from the Sparkfun kit

10 Servo motor control, Begin Solidworks drawing
Be able to identify characteristics that distinguish a servo and a DC motor
Be able to describe the difference a conventional servo and a continuous rotation servo
Be able to use the Arduino Servo library to control servo position
Be able to launch Solidworks to begin drawing of the fan parts

11 Midterm exam

12 Desktop Fan Wrap-up, What is Design?
Be able to connect a momentary button to an LED circuit such that pushing the button turns on the LED
Be able to describe the function of and need for a pull-down or pull-up resistor in a digital input circuit for a momentary button
Be able to build a circuit that uses a momentary button for digital input to an Arduino
Be able to write a wait-for-input sketch on an Arduino that uses a momentary button for input
Be able to describe the difference between a wait-for-input algorithm and an interrupt-driven algorithm that responds to a digital input
Be able to create a hand sketch of the structure of the desktop fan
Be able to complete the Solidworks drawing of the structure for the desktop fan

13 Introduction to Linear Regression; Completion of desktop fan fabrication
Be able to manually calculate the slope and intercept for a least squares line fit to data
Be able to complete the fabrication of the desktop fan

14 Intro to pump fabrication, least squares polynomial regression, R2
Be able to compute and interpret the R2 coefficient of a least squares line fit
Be able to use Excel's TRENDLINE function to add a least squares line fit to data
Be able to use Excel's TRENDLINE function to add a least squares fit of a polynomial to data
Be aware of pump fabrication steps and responsibilities for students
Be aware of the 3D solid modeling necessary for the impeller fabrication.

15 Least squares fitting to exponential and power law functions, 3D model of pump impeller
Be able to perform power law, semi-log, and log-log curve fits with the Excel Trendline function
Be able to create a 3D solid model of a pump impeller by following the Solidworks tutorial
Be ready to begin fabrication the pump body with the milling machines in the lab

17 Finish pump fabrication, begin pump assembly; Overview of pump performance
Be aware that Quiz 2 will be given next week
Be able to finish fabrication of your pump
Be able to assemble the pump
Be able to describe the basic shape of a pump curve, and identify the no flow and maximum flow conditions.

18 Pump testing
Be aware that Quiz 2 is next class meeting

Be able to get your pump to work
Be able to describe the basic shape of a pump curve, and identify the no flow and maximum flow conditions.
Be able to measure the pump curve and pump efficiency versus flow rate
Be able to perform polynomial curve fit with the Excel TRENDLINE function

19 Quiz 2, Finish pump testing
Complete the pump testing, and data analysis so that you are ready for the final report on the pump.
Be aware of the requirements for the final report on the pump