THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department of Electronic and Computer Engineering
ELEC 1100

Laboratory 2: Diodes and DC Regulation (5%)

A) Objectives

- To get familiar with circuit diagram and circuit construction on breadboard.
- To construct a regulator to transform DC voltages.

B) Equipment

- Diodes (1N4148), Zener Diode (1N4734), Voltage Regulator (LM7805)
- Resistors, Capacitors

C) Prelab (solution included)

- Q1 Indicate the polarity of the diodes below.

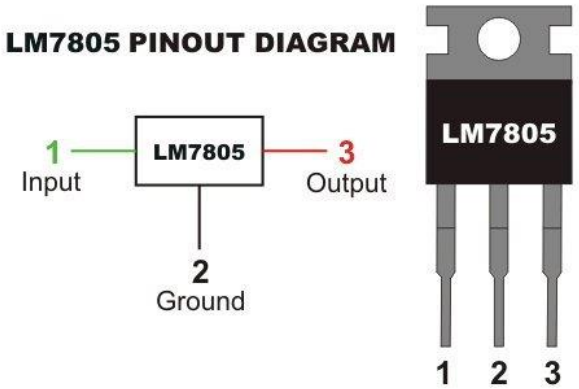
Diode Zener Diode

- Q2 What is the difference between a Zener diode and a diode?

  Zener diode allows current to flow when the reverse voltage is larger than a certain value.

- Q3 How to identify each pin function of LM7805?

  Let the number side of LM7805 face to you, from its left to right are pin 1 (Input), 2 (Ground) and 3 (Output) as shown below.



- **Review all the techniques in connecting components and measurement in Lab#01.**
- **Unless otherwise specified, all the negative terminals of equipment used in experiment should connect to the GND connection of a circuit.**

D) Experiment Procedures

Review: Generating a $10V_{pp}$ Sine Wave (~10 mins)

(Note: Refer to Lab#01, Experiment 6 if you forget the procedures.)

Step 1: Switch on the Function Generator and reset it by pressing SHIFT and then RCL .

Step 2: Set the function to **Sine Wave**, and the amplitude to **5V**.

Step 3: Set the frequency to **(1+x/100) kHz**.

Note: In this lab, let x be the number represented by the 6th and 7th digits of your student ID. For example, if your student ID is 12345678, then x = 67.

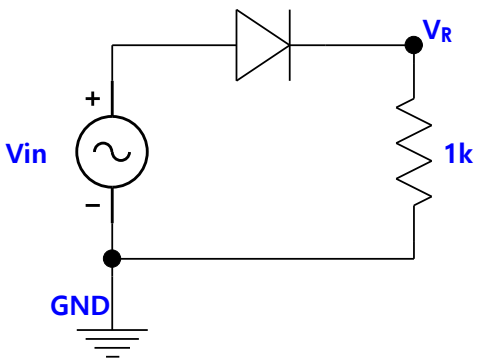
Step 4: Turn on the DSO, select the language, and connect the DSO probe. Remember to set both of the DSO setting and DSO probe to **1X**.

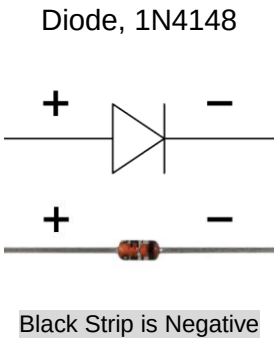
Step 5: Connect the Generator probe to the DSO probe using wires. You should see a $10V_{pp}$ sine wave on the DSO.

****** TA Check 1: Show your generated sine wave to TA. Each member of a group should demo once, using your own student ID for x.**

Experiment 1: Diode Circuit (~20 mins)

Step 1: Construct the circuit shown below. Note the polarity of the diode 1N4148.





Step 2: Use the generated $10V_{pp}$ sine wave in **Review** part as V_{in}.

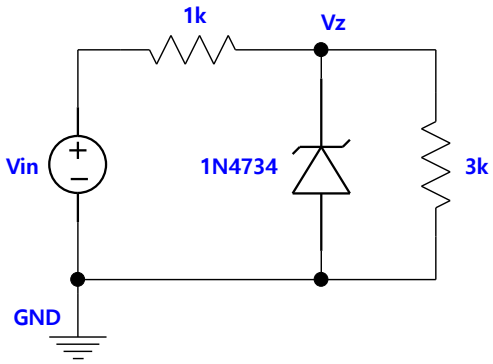
Step 3: Connect CH1 of DSO to measure V_{in} and CH2 to measure V_R (voltage across the 1 kΩ resistor).

Step 4: Press AUTO SET button to display both of the waveforms.

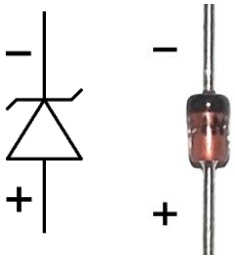
****** TA Check 2: Show your measured waveforms to your TA.**

Q1: What is the difference between the two waveforms? Briefly explain your answer (the feature of a diode).

Experiment 2: Zener Diode in Voltage Regulation (~30 mins)



Zener Diode, 1N4734



Step 1: Construct the circuit above. Note the polarity of the Zener diode.

Step 2: Refer to Lab#01, set V_{in} (i.e. power supply) to 1V.

Step 3: Use the digital multimeter to measure V_Z and record the reading in summary sheet.

Step 4: Slowly increase V_{in} by 1V. Measure V_Z and record the reading.

Step 5: Repeat step 4 until V_{in} = 16V.

Q2: Complete the table of experiment result.

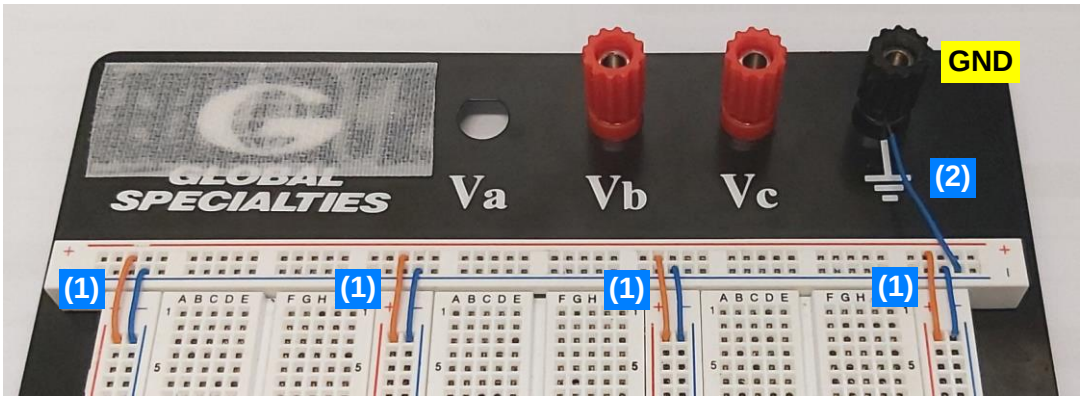
Q3: From your record in Q2, what is the breakdown voltage of the Zener diode (give a rough number)?

Experiment 3: LM7805 Voltage Regulator (~30 mins)

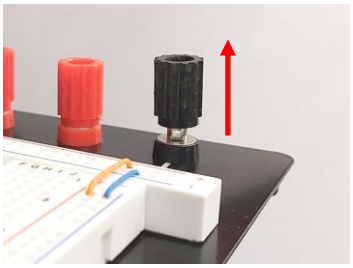
Start from now, you are going to construct circuits using ICs for final project use. Nearly all the components we use require the same supply voltage, **5V**. For the tidiness of your breadboard, you should prepare 5V and GND connections using the bus strips.

Note: If there is no color marking on the bus strip, you may want to draw red lines and blue lines on the bus strip according to the photo.

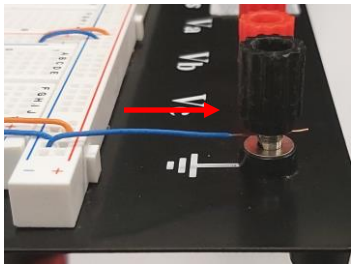
Step 1: On your breadboard, connect all the rows of bus trips with the same color together. All the rows with red lines will be used as 5V connection, while all the rows with blue lines will be used as GND connection. This breadboard arrangement shall not be changed throughout the course.



Step 2: Connect a wire from the GND row of the bus strip to the black binding post.



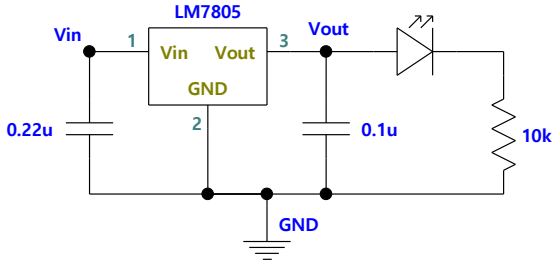
1. Unscrew the plastic housing



2. Insert wire into the hole. Note the openings of the wire is ~15mm.

3. Screw tight the housing. Make sure that the wire's insulator is not grabbed.

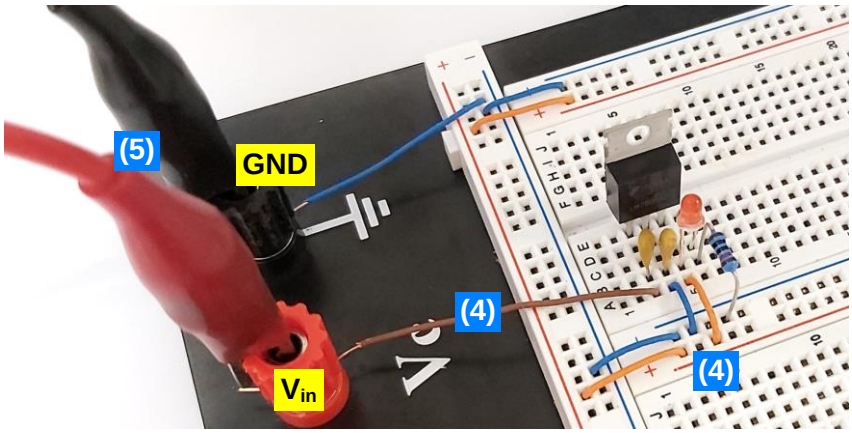
Step 3: Construct the circuit below.



(the markings is facing up)

Step 4: Connect V_{in} to the red binding post. Connect V_{out} to 5V-row, and GND to the GND-row.

Step 5: Set the power supply to 0V and connect to the binding posts.



The arrangement of components are for reference only. The main goal should be the correct connections and the tidiness for easy debugging.

Step 6: Set the multimeter to measure DC voltage at V_{out}.

Caution: Do NOT touch the regulator LM7805 as it gets hot when operating. However, if a bad smell comes out, turn off the power supply immediately and ask TAs for help.

Step 7: Slowly increase the V_{in} (i.e. power supply) to about 8V, the maximum reading of multimeter reading should be about 5V. If the maximum reading is close to 8V, turn off the power supply and check your circuit connection, and repeat Step 7. If the problem still exists, ask TAs for help.

Step 8: Increase V_{in} to 12V and check if V_{out} is still about 5V.

****** TA Check 3: Show your TA that you have finished the circuit and obtained 5V output from 12V.**

DO NOT remove the LM7805 voltage regulator circuit.

Keep the circuits you finished on the breadboard for the future.

Remember to clean up your bench! A messy table will cost 3 points!