

## Photo Diode and LED Characteristics

### Preliminary Work

1. Understand the working principle of LEDs and photodiodes and study the operation of the circuit below that you will use in this lab.
2. Find the datasheets of the photodiode (pd333-3b/h0/l2) and the LED (SB-5010IRB) that are used in this lab and understand at what wavelength range (in nm) they operate. Explain why the circuit is chosen to operate at this wavelength range. (Why didn't we use the visible wavelength?)

### Lab Work

You will detect the infrared radiation emitted by an LED using a photodiode in this experiment. The circuit is given below in Fig.1. The infrared radiation induces a current on the photodiode which is then converted into voltage by a transimpedance amplifier. The envelope detector at the output of the OPAMP is intended to detect the amplitude of the AC output. Use pd333-3b/h0/l2 for photodiode and SB-5010IRB for LED. Both are available in the lab. As the input, use  $V(t) = 3\sin(2\pi \cdot 1000)$ . You can change  $V(t)$  amplitude based on your needs.

a) Find an  $R_2$  value which will produce a signal amplitude value below the OPAMP's saturation voltage. You will need to experiment to find the current produced by the photodiode. Try for different  $R_2$  values and  $V(t)$  amplitudes. Question: How should I choose  $R_2$ ?

b) Find  $R_3$  and  $C_1$  values which will provide constant DC voltage at the output node. Explain the logic behind choosing  $R_3$  and  $C_1$  values.

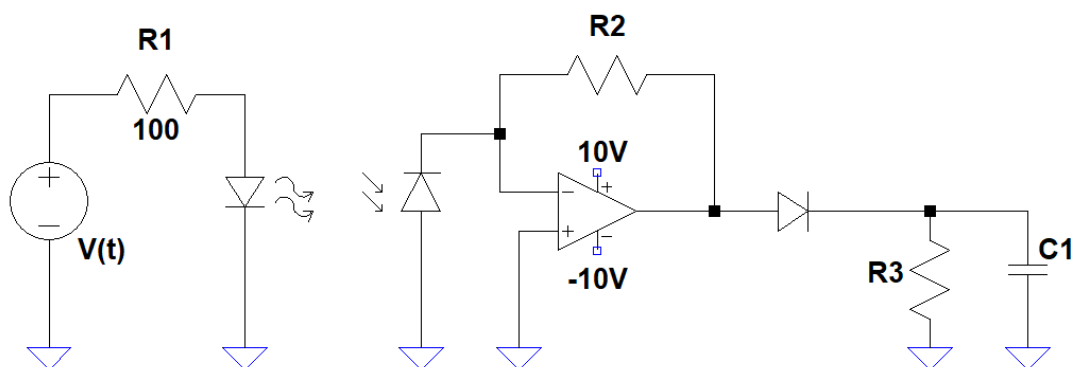


Figure 1: Circuit to be used in this lab

Note 1) Read the datasheets of pd333-3b/h0/l2 and SB-5010IRB beforehand to guide your work and identify the leads correctly.

Note 2) Keep the distance between the LED and photodiode constant as much as possible to obtain reliable data.

You should be in the lab and have your circuit ready during the check-out. You are expected to demonstrate a working set-up and be able to explain how the circuit works and what your results are. Your assistant will ask you questions about your lab and your preliminary work. You are expected to work individually and demonstrate that you fully understand the results of the lab. You will also write a report about the lab (If you do not pass your check-out, you will not be eligible for submitting your report). In your report clearly explain the circuit operation, how you decided on the values of  $R_2$ ,  $R_3$ , and  $C_1$ . Also include the scope screen shots and

corresponding explanation of the voltage on LED, output of the OPAMP, and the output voltage on R3 and C1. Comment on how the transmitted and received IR radiation can be maximized. Also answer the preliminary questions in your report.

**You have 1 week to complete the lab assignment. You should show the working circuit to your TA and get a check during your lab session in the week of September 25. The deadline to submit your report to Moodle is October 11.**