Electrical Circuits LAB #6 - Amplifier and Light level detector

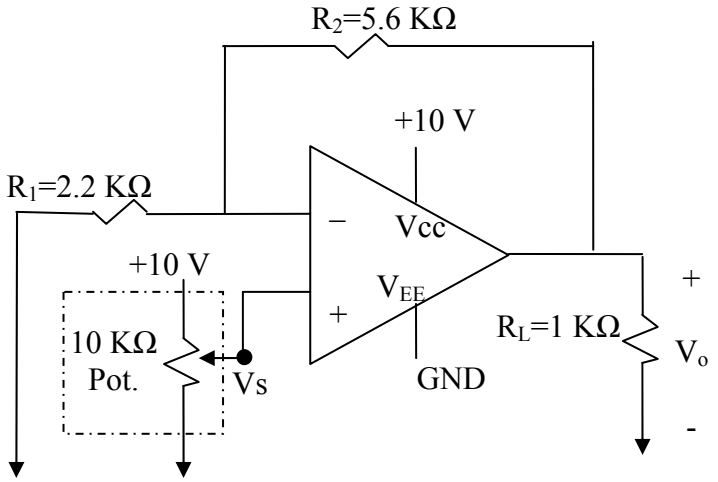
Objectives

Understand and apply Op Amp concepts as well as light level detection basics.

Material

- Textbook: Electrical Circuits by Nilsson
- Instruments: Power Supply and Multimeter
- Supplies:
  - Electrical Tool Box
  - Proto Board
  - Probes & Connecting Cables
  - One Solar module
  - One LM 324
  - 10 KΩ Potentiometer
  - Available Resistors

Experiment 1



a) Use the ideal Op Amp model to find Vo in term of Vs for the above circuit. Calculate and record the values of Vo for Vs =1 to 4 Volts in 0.5 volt increments.

b) Implement the above circuit using LM 324 Op Amp. LM 324 Data Sheet is available on the Component Webpage of the Course Website. Measure and record the value of Vo for Vs = 1 to 4 Volts in 0.5 volt increments.

c) Compare the calculated value in section (a) and measured value in section (b). Specifically, identify and explain the reasons for any difference between measured and calculated values.

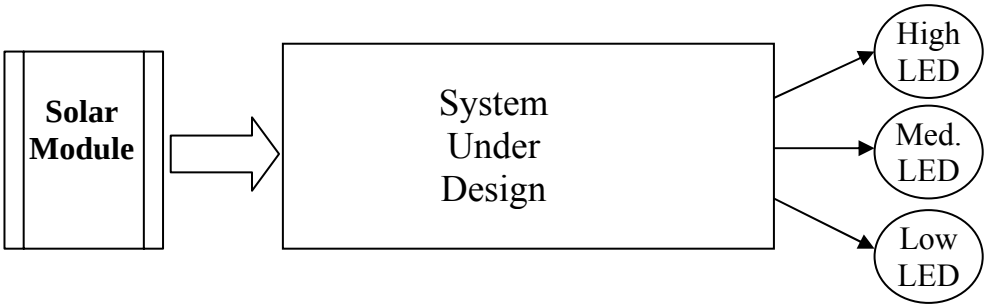
d) Use the DC model of LM 324 Op Amp to find Vo in terms of Vs for the above circuit. Calculate and record the value of Vo for Vs =1 to 4 Volts in 0.5 volt increments.
Hint: $R_o = 75\ \Omega,\ R_i = 2\ M\Omega,\ A = 10^5$

e) Explain the similarities and differences of Vs and Vo values in sections (a), (b) and (d). Additionally, describe the criteria for selecting the optimal OpAmp model to analyzing resistive circuits that include Op Amp.

Experiment 2

The objective of this experiment is to design a circuit that accepts as input, solar module output, and turns on LEDs to indicate the level of ambient light present. LEDs should turn on according to the following specifications:

- High LED is on when Light level is more than 75% maximum.
- Med LED is on when Light level is more than 50% maximum.
- Low LED is on when Light level is more than 25% maximum.



Show your design process, including reasons for your design choices. Calculate and measure critical voltages and currents to verify your design. All teams should have completed and verified schematics (including pin numbers) of their design before attempting to implement the circuit.

Designers are responsible for identifying critical voltages and currents for their designs. These measurement points are typically referred to as test points and are used for manufacturing/final product testing in addition to design verification.

Instructor's review of implementation and signature will be required for this lab.

Report Requirements

Reports must be prepared individually even if the experiments are performed as a team. All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum include:

For each Experiment

a) Clear problem statement; specify items given and to be found.
b) Identify the theory or process used.
c) Documents resulting circuits, calculation, tables, timing diagram, schematic and other relevant results.

For the report as a whole

a) Cover sheet with your name, class, lab, completion date and team members' names.
b) Lessons Learned from the experiments.
c) A new experiment and expected results which provide additional opportunity to practice the concepts in this lab.