Indian Institute of Technology, Bombay
Department of Electrical Engineering
Electronic Devices Lab(EE-236)
Mid-Sem Exam Part 1, Date: March 02, 2022

Timing: 2:00 PM to 2:50 PM | Spring 2022 | Max marks: 10

1 Instructions

- You are allowed to use only those models that have been provided. You can download by clicking the name.
- You need not edit any model file.
- You can use previous lab report and netlist only.

2 Problem Statements

1. (a) In this question you have to find the temperature dependence of a Zener diode (BZT52C18S) and normal silicon PN junction diode ($Diode\_1N914$). Zener diode is typically operated in reversed bias and PN junction in forward bias. Click here to download the model files.
   - Plot the I-V characteristics of both diodes with temperature varying from 20°C to 80°C (One plot for each diode with temperature varying in steps of 10°C). Use appendix for hints.
   - Plot the **Voltage across the diode vs. Temperature** curves for 2 mA current through the PN diode and -0.5 mA current through the Zener diode in two separate plots.
   - Find the value of the **temperature coefficient** from the above plots **(in mV/°C)** for both the diodes and comment (e.g. if the voltage across the diodes increases or decreases with temperature). ***(1 + 2 + 2 Marks)***

   (b) Previously you have done the experiment on Voltage regulator circuit (see Figure 1). Now you have to make changes in the circuit to make it temperature independent i.e. voltage across the load should not change with temperature.
   - **Specs:**
     1. $V_{out} = 20V$;
     2. $12V \leq V_s \leq 30V$;
     3. $\Delta V_{out} \leq |1| mV/°C$ for temperature variation from 20°C to 80°C.
   - For the value of V_{out} given above, calculate the values of the resistances Rs, R1 annd R2. Make necessary changes and redraw the circuit to make it temperature independent and explain your choice. Plot the output voltage vs input voltage ($12V \leq V_s \leq 30V$).
   - Plot V_{out} for a fixed V_S = 25 V with temperature varying from 20°C to 80°C in 10°C interval and show that you have achieved the desired goal of temperature independence by comparing the variation in V_{out} vs Temperature with the same

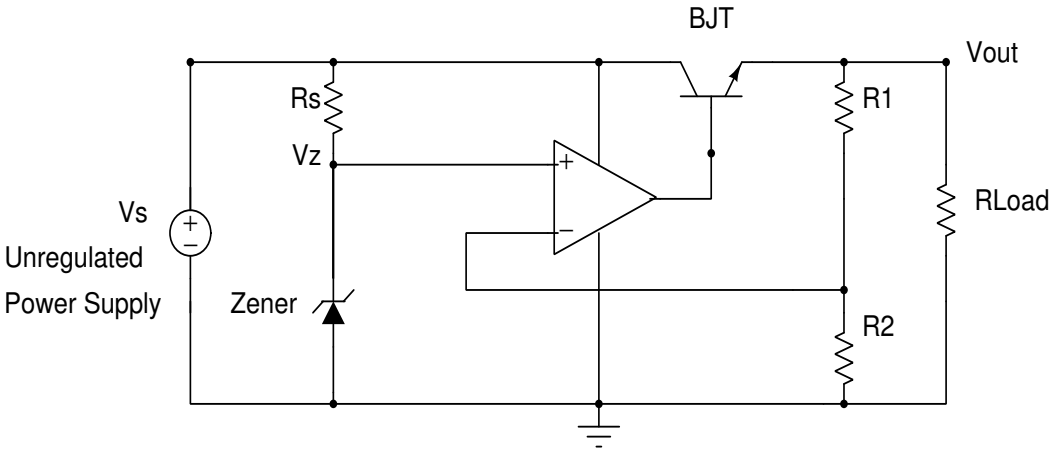

Figure 1: Voltage Regulator

for the previous circuit (without temperature compensation). There can be slight variation of V_{out} between compensated and uncompensated one but compensated one should meet the above mentioned spec for V_{out}. **HINTS: You may add PN diode/s in this circuit.** (OP-AMP: ua741) ***(2 + 3 Marks)***

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3 Appendix

Command for temperature sweeping:
.dc vin 12 30 0.1 temp 20 80 10