VE311 Electronic Circuits

Summer 2023 — Lab 1

Instructor: Dr. Xuyang Lu

Due: 11:59 pm, June 17, 2023 (Friday)

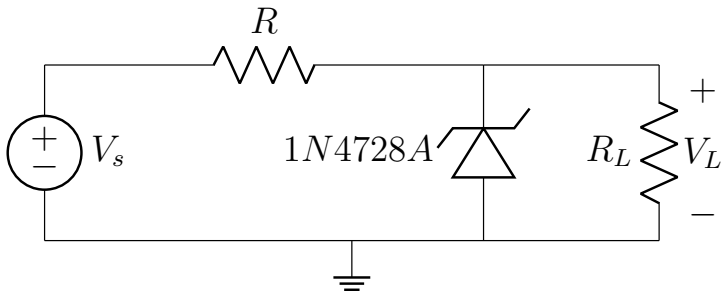
Note:

1. Please use A4 size papers.
2. The lab report should be submitted online individually.
3. Use Proteus 8.10 for simulation before the lab session. In the Proteus library, you should be able to find all the components used in the schematics. The lab report must include both the simulation and measurement results.

Exercise 1.1

[Voltage Regulator] Build the voltage regulator below in Proteus and on the breadboard.

1. [10%] For $\mathrm{V_s} = 5\ \mathrm{V}, \mathrm{R} = 10\mathrm{k}\Omega$ and $\mathrm{R_L} = \infty$, use a voltage meter to obtain the value of $\mathrm{V_L}$. Discussion: Whether the obtained $\mathrm{V_L}$ is reasonable, in comparison to the V_Z in the 1 N4728 A datasheet?
2. [20%] For $\mathrm{V_s} = 5 + 0.5\sin(2\pi 60\cdot \text{ time})$, $\mathrm{R} = 10\mathrm{k}\Omega$ and $\mathrm{R_L} = \infty$, display both V_S and V_L on oscilloscope. Estimate the line regulation by comparing the amplitudes of V_S and $\mathrm{V_L}$. By using the equation: line regulation $= R_\mathrm{Z}/(\mathrm{R} + \mathrm{R_Z})$, estimate the value of $\mathrm{R_Z}$. Discussion: If $V_\mathrm{S} = 2 + 3\sin(2\pi 60\cdot \text{ time})$, how will V_L change?
3. [20%] For $V_s = 5$ V and $R = 10\mathrm{k}\Omega$, by gradually decreasing R_L, find out the minimum $\mathrm{R}(\mathrm{R_{L,min}})$, below which the voltage regulator stops working. Discussion: How to modify the voltage regulator so that $\mathrm{R_{L,min}}$ becomes 2 times smaller?



Exercise 1.2

[Half-Wave Rectifier] Build the half-wave rectifier circuit below in Proteus and on the breadboard.

1. [50%] For $V_{\mathrm{s}} = 5\sin(2\pi 60\cdot \text{ time})$ and R = 1kΩ, find out the value of C so that the ripple voltage ($\mathrm{V_r}$) is smaller than 0.1 V. Display $\mathrm{V_{out}}$ on oscilloscope to confirm V_r is indeed smaller than 0.1 V, and estimate $V_{\mathrm{dc}}, I_{\mathrm{dc}}, \theta_{\mathrm{c}}, \Delta\mathrm{T}, \mathrm{I_{peak}}, I_{\mathrm{surge}}$ and PIV based on the waveforms. Make sure the half-wave rectifier is reliable, that is $\mathrm{I_{peak}}, \mathrm{I_{surge}}$ and PIV lower than the maximum ratings from the 1 N4007 datasheet. Discussion: How will V_{r} change, if $V_{\mathrm{s}} = 5\sin(2\pi 120\cdot \text{ time})$?