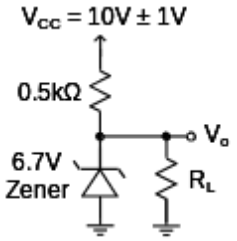
# EECE 2412 – Homework 4 – Spring 2017

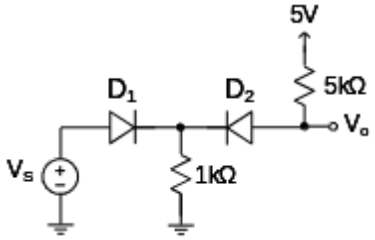
Due: Monday 27 February 2017

1) Read Section 3.7 of the textbook and check your understanding by completing the exercises at the end of this section before solving the following problem. The 6.7V Zener diode in the circuit below is specified to have $V_{zo}$ = 6.7V, and $r_z$ = 20Ω. The supply voltage $V_{CC}$ is nominally 10V, but can vary by ±1V. To analyze this circuit, use the model for a Zener diode in the breakdown region that is provided in the lecture slides. Another specification for this Zener diode is that $I_{ZK} = -I_D \geq 0.2$mA is required to ensure that the diode remains in the breakdown region (instead of the idealized case in the lecture notes, where the edge of the breakdown region is defined as $I_Z = -I_D > 0$).

   a. Find $V_o$ without load and the nominal $V_{CC}$ value (of 10V).
   b. Find the change in $V_o$ (±Δvolts) resulting from the ±1V supply voltage variation.
   c. Find the change in $V_o$ resulting from connecting a load resistance $R_L$ = 2kΩ (for the case with nominal supply voltage of $V_{CC}$ = 10V).
   d. Find the value of $V_o$ when $R_L$ is changed to 0.5kΩ (with nominal supply voltage of $V_{CC}$ = 10V).
   e. For the complete supply voltage range (9V < $V_{CC}$ < 11V), what is the minimum $R_L$ for which the diode still operates in the breakdown region?




2) Use the constant voltage drop model (with $V_{do}$ = 0.7V in the forward bias region) to plot the transfer characteristic from the input $V_S$ to the output $V_O$ in the circuit shown below. On the x-axis, use a range for $V_S$ from 0 to +10V. Clearly label the voltages at which the diodes switch on/off, and label the slopes of the curve in all regions around the switching points in the plot ($V_O$ vs. $V_S$). Show the analysis steps that you used to plot the transfer characteristic.




3) Problem D3.28 on page 192 in the textbook (Allan R. Hambley, Electronics, 2nd edition).

4) Part a) is Problem 3.53 on page 194 in the textbook. Extra part:
   b) Calculate the source regulation for this circuit without load based on the result from part a).

5) Use PSPICE to plot the transfer characteristic ($V_o$ = V vs. $V_{in}$) for the diode circuit in Fig. P.17b on page 191 in the textbook with the "Dbreak" diode model and a sweep range of -10V ≤ $V_{in}$ ≤ 10V. Mark the voltage levels in the plot at which the diodes turn on/off. Simulate the transient output voltage with an input of $V_{in}(t) = 3V \cdot \sin(200\pi \cdot t)$, and repeat the transient simulation with an input of $V_{in}(t) = 10V \cdot \sin(200\pi \cdot t)$. For both cases, mark the peak voltage levels in the plot. Submit the schematic of the circuit and the relevant plots.