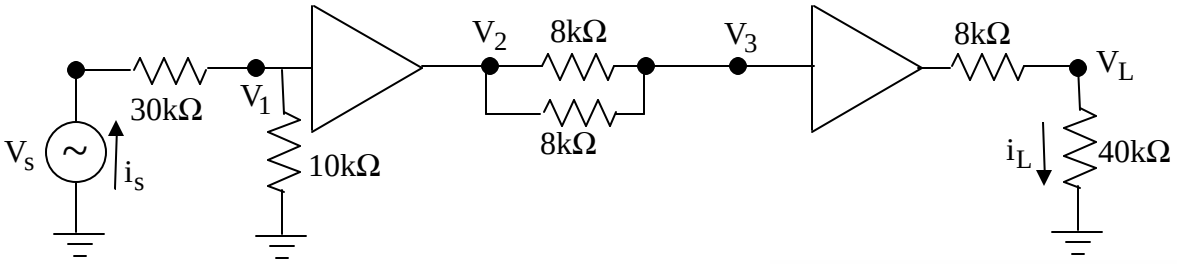
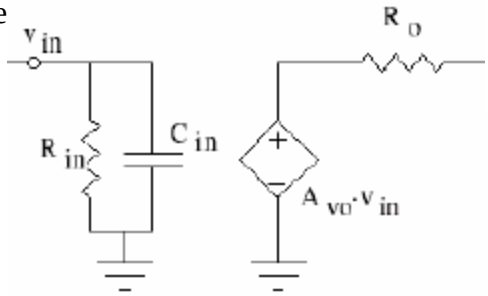
ECE2280 **Homework #3** **Spring 2007**

1. V_s is an AC signal. Both amplifiers have the following characteristics:

A_{vo}=20, R_{in}=10kΩ, R_o=2kΩ, Clipping levels: L=±12V (unloaded) f_T=3MHz



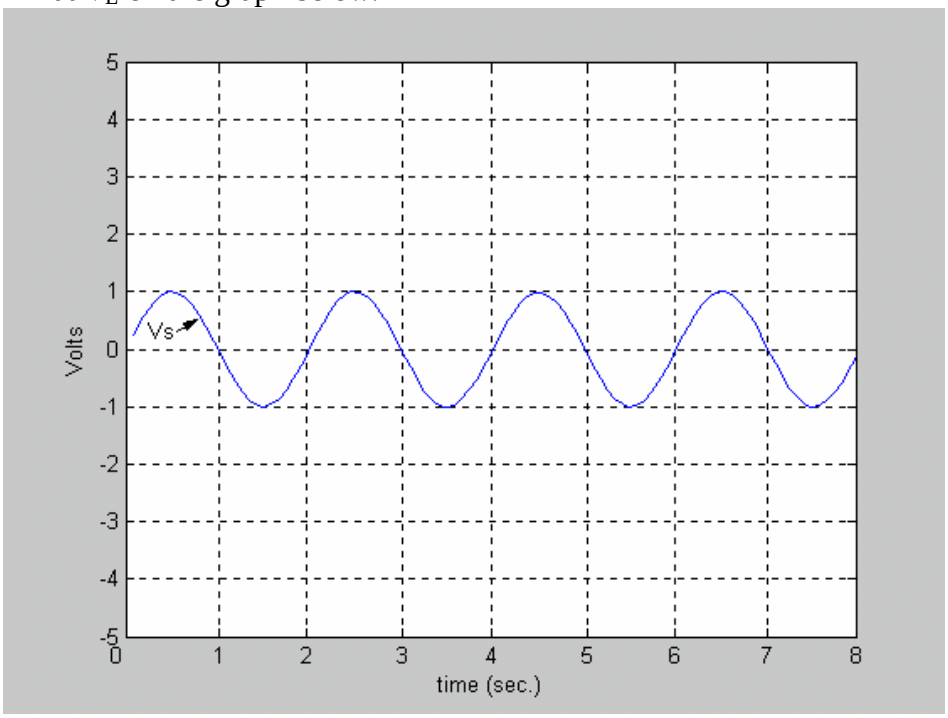
(a) Draw this 2 stage amplifier using the following model. Make sure to label V_S, V_1, V_3, and V_0 on the schematic. Cin=3pF. Find V_L/V_s frequency response transfer function. Sketch the Bode plots using a straight line approximation and using MATLAB.



(b) What is the overall gain for this circuit.

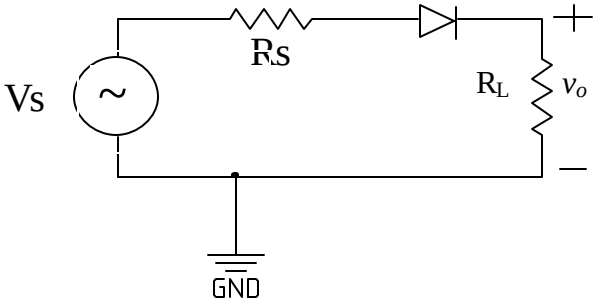
(c) What is the exact frequency for the f_{3dB} point. (solve with the equation)

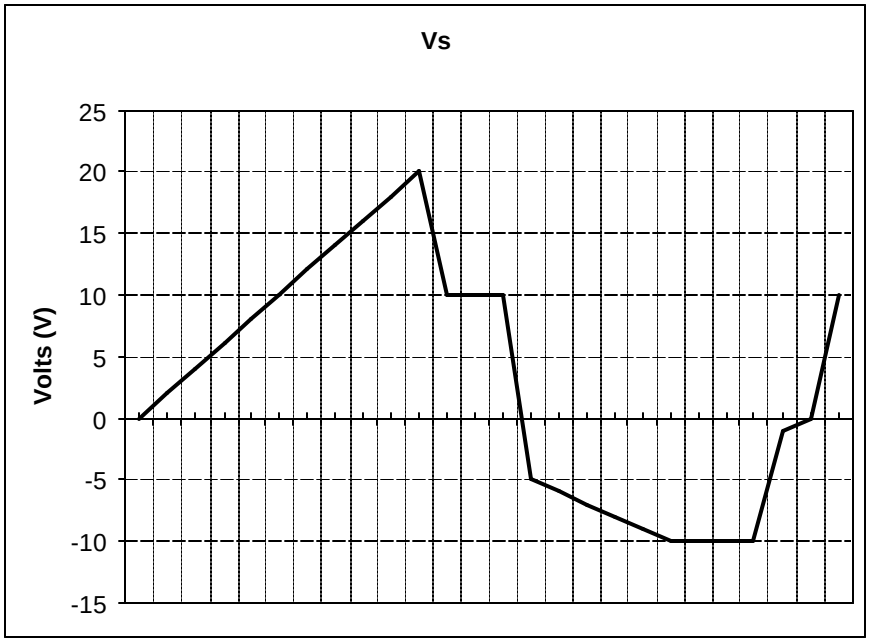
(d) For the input V_S as shown, sketch (make the peaks exact and estimate between the peaks) the output at V_L on the graph below.



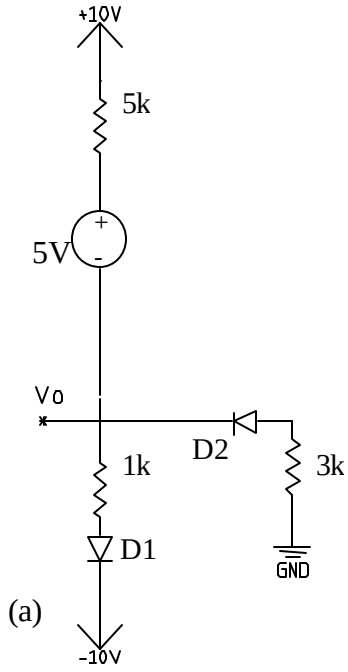
(e) Find $A_i = i_L / i_S$. Express your answer as a ratio(A/A) and in dB. [Round the answer to the nearest whole number]

2. Assume the diode is ideal. Let Rs = 4kΩ, R_L=1kΩ. Sketch and clearly label the output voltage v_o. Vs is shown in the graph below.

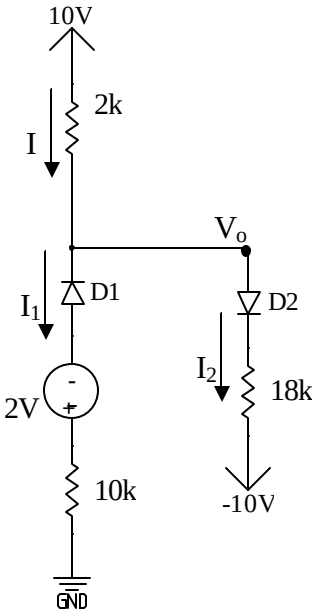




3. Use the constant voltage drop diode model with V_{D0}=0.7 to solve the circuits below for all currents in all branches of the circuit and Vo. Verify your answers.



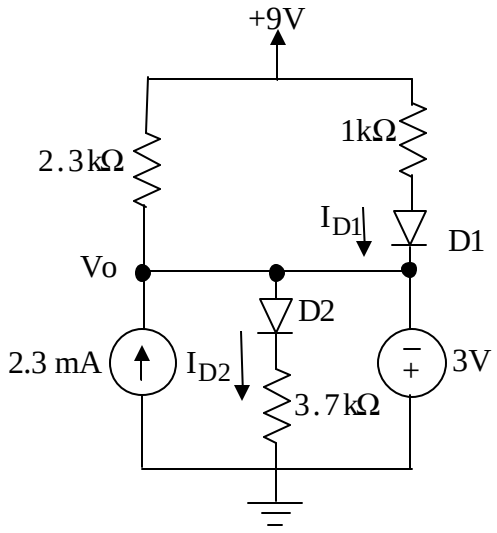
(a)



(b)

4. Assume all diodes are identical and have V_{DO}=0.7V, n=1, and V_T=25mV. Use the constant voltage drop method. Verify that your assumption for the diode operations(i.e. on or off) are correct. Find the following making sure you find the correct operation of the diodes.

a) The current I_{D1}
b) The current I_{D2}
c) The voltage Vo
d) If there is noise on the +9V supply of ±1V, what is the value for i_d (the AC current through diode, D1). *{Hint: remember to use the AC model for the diode}*

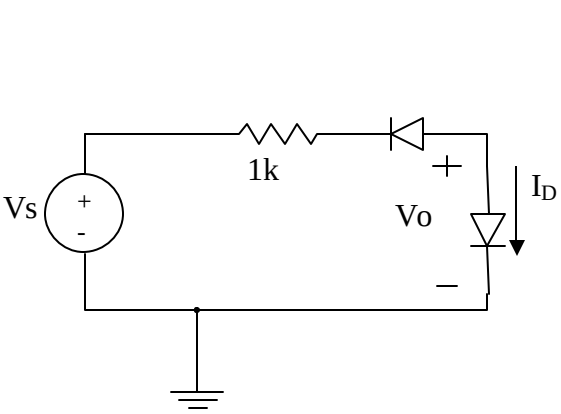


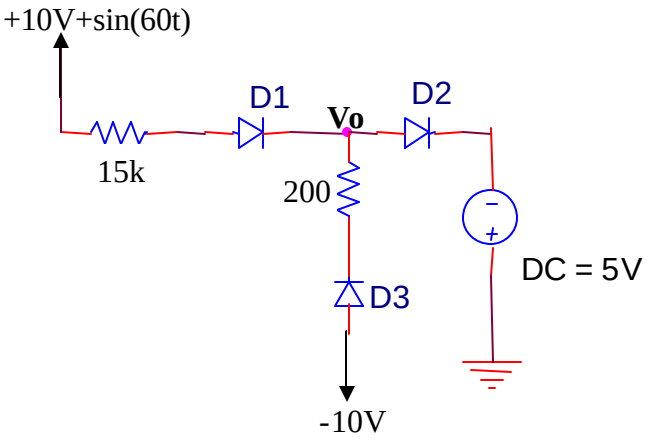
5. Use PSPICE to simulate the circuit in 4 for DC values. Compare to your answers in 4.

6. For the circuit in (a), assume V_{DO}=0.7V, n=2, and V_T=25mV.

For the circuit in (b), assume V_{DO}=0.6V, n=1, and V_T=25mV.
Assume identical diodes and use the constant voltage drop method when appropriate. For each circuit below,

a) Determine the **DC** component of the diode currents through all diodes, I_D.
b) Determine the **DC** component at the output, V_o.
c) Determine the **AC** component of the diode currents through all diodes, i_d.
d) Determine the **AC** component at the output, V_o.
e) What is the **total** output for V_o (Dc and AC).





(a)Vs= 0.7+2sin(ωt) (b)