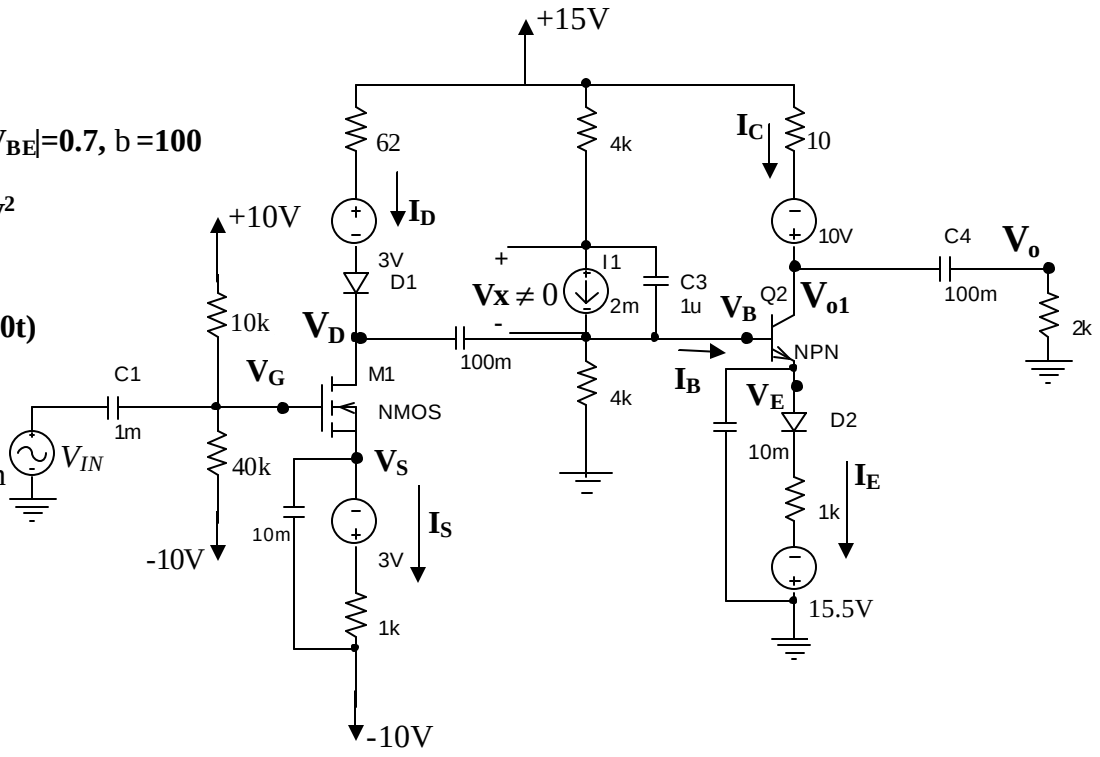
1. Use: ignore r_o, $|V_{BE}|$=0.7, b =100
V_t=1V
k_n'(W/L)=10mA/V^2
l =0
V_{DO}=0.8V
***V_{IN}* = 5+0.001sin(20t)**



For DC analysis, assume that the capacitors are open

(a) Solve for the DC currents:
   a. I_D
   b. I_S
   c. I_B
   d. I_E
   e. I_C

(b) Solve for the DC voltages:
   a. V_G
   b. V_S
   c. V_D
   d. V_B
   e. V_E

(c) Verify that the MosFet transistor, M1 is saturated. Verify that the BJT transistor, Q2 is active.

2. Create a rough sketch of the total waveforms seen at **Vo and V_{o1}** given V_{IN} stated above, V_B/V_{IN}=-3V/V, and Vo/V_B= -27V/V. Make sure to label all relevant y-axis values (maximum, minimum, etc.). First draw Vo1 and then draw Vo. There should be 2 sketches.

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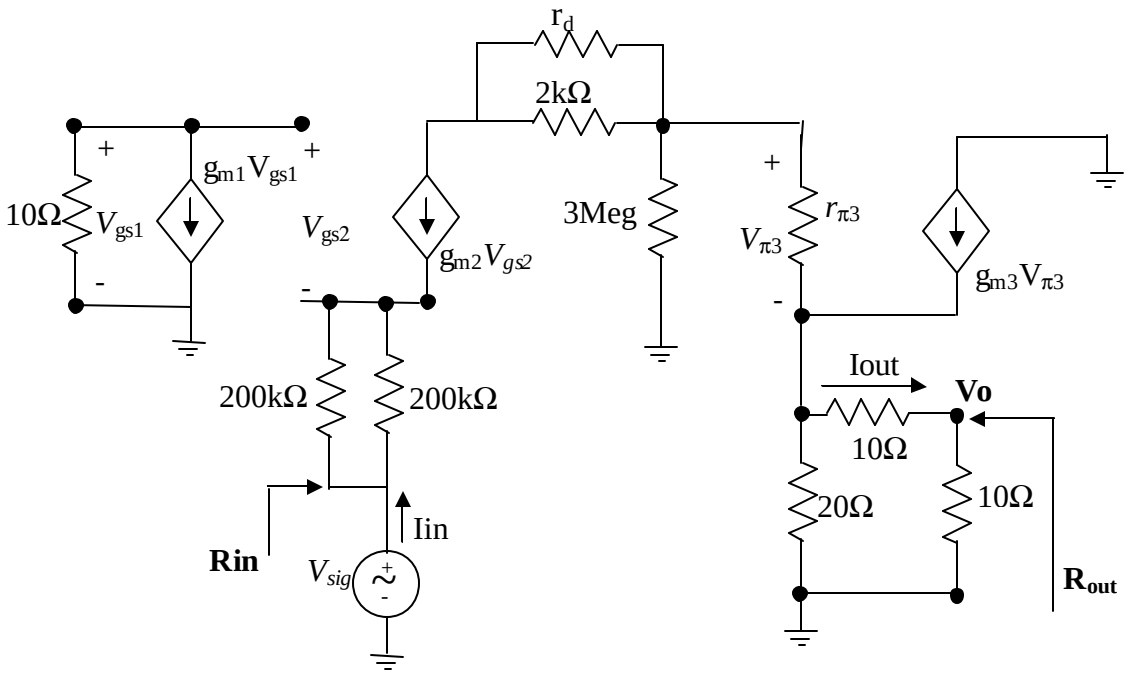
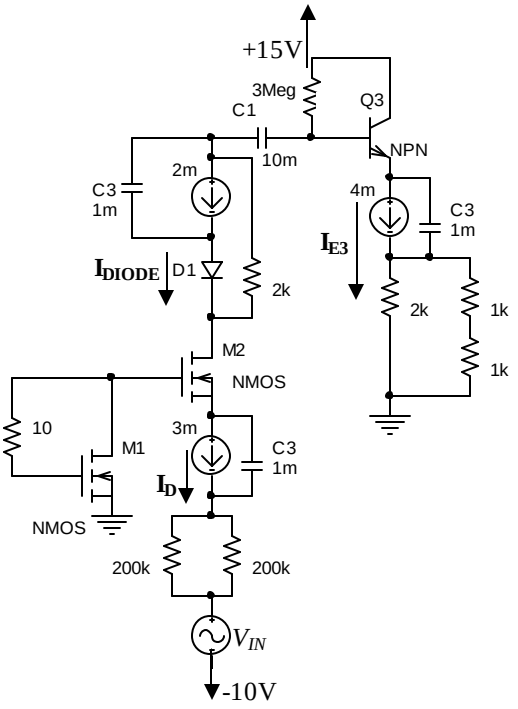
3. Use the circuit on the next page: **ignore r_o and** l , **$|V_{BE}|$=0.7,** b **=100, n=1, V_T=25mV, Vt(threshold voltage)=1V, k_n'(W/L)=10mA/V^2, *V_{sig}* = 0.02sin(20t), I_{E3}=4mA, I_{DIODE}=2mA, I_D=20mA**

For the following hybrid-π equivalent circuit below, find the following values:
(a) Find r_d, $r_{\pi 3}$, g_{m2}, and g_{m3} values.
(b) R_{in} (input resistance –ignore only the input source, *Vsig*; include **all** resistors seen above *Vsig*)
(c) R_{out} (output resistance- include **all** resistors at node {**no load is connected**})
(d) midband gain, $\frac{Vo}{Vsig}$

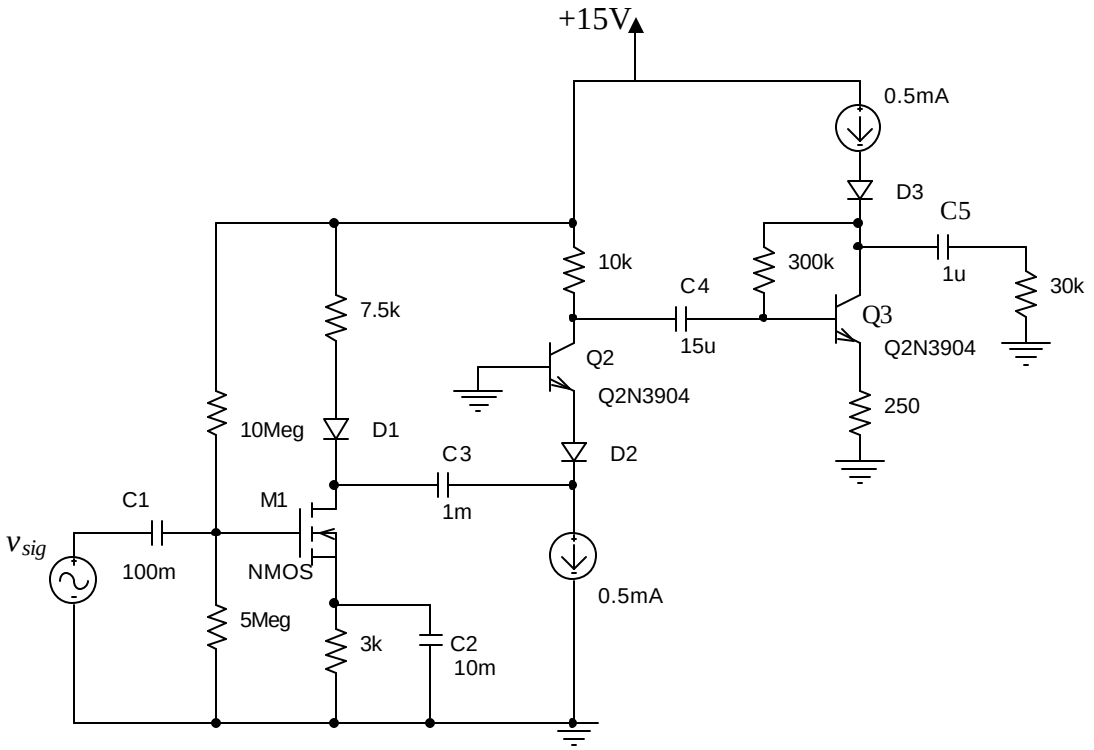
4. (a) Explain why or why not this is a good amplifier for voltage amplification, Vo/*Vsig*.
(b) Explain why or why not this is a good amplifier for current amplification., Iout/Iin.





5. For the circuit shown below:

Draw the AC small-signal equivalent circuit(use hybrid-π or model T). Make sure that everything is labeled in terms of the transistor number. (e.g. g_{m1}, $v_{\pi 2}$, etc.). **Include r_o** for all transistors. v_{sig}=0.001sin(10t) AC.



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6. $|V_{BE}|$=0.7, β=100, ignore r_o,, V4 ={0.1sin(ωt)}Volts. Assume that the applied signal frequency is adequate to keep the circuit operating in the flat midband region. Assume that the capacitors act as an open for DC operation and a short for AC operation. The following DC values were measured:
I_D=1.3m, VD=9V, VG=6V, VS=3.1V, IE=12mA, VE=2.3V, VB=3V, VC=10V.

The AC gain was measured to be Vo1/V4=83V/V, Vo2/Vo1=1V/V, r_π=200Ω, g_{m_MOSFET}=5mA/V.

- Does this circuit operate as a **linear** AC amplifier with the applied shown voltage? If so, what is the gain, $\frac{Vo}{Vsig}$, of the following circuit? If not, explain why.

7. Assume that C2 and C6 contribute pole values less than 1rad/sec. Calculate the pole contributions of C2 and C4. What is f_L (in rad/sec)?