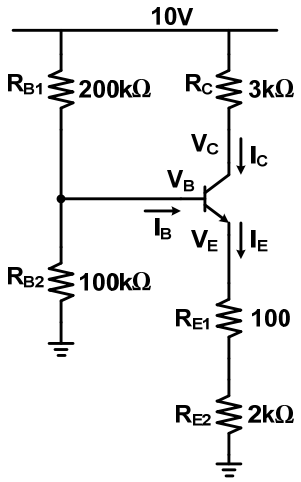
March 21, 2024

ECEN 325

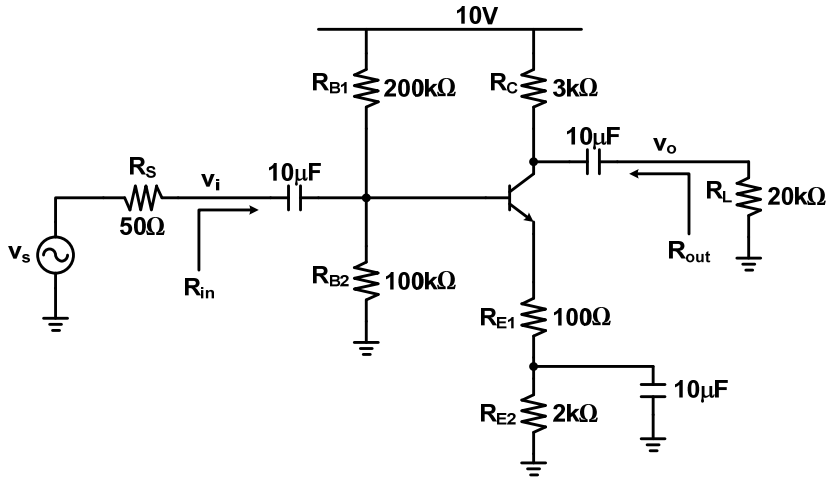
Homework #5

Due: April 2, 2024, 11:59PM
Homeworks will not be received after due.
Instructor: Sam Palermo

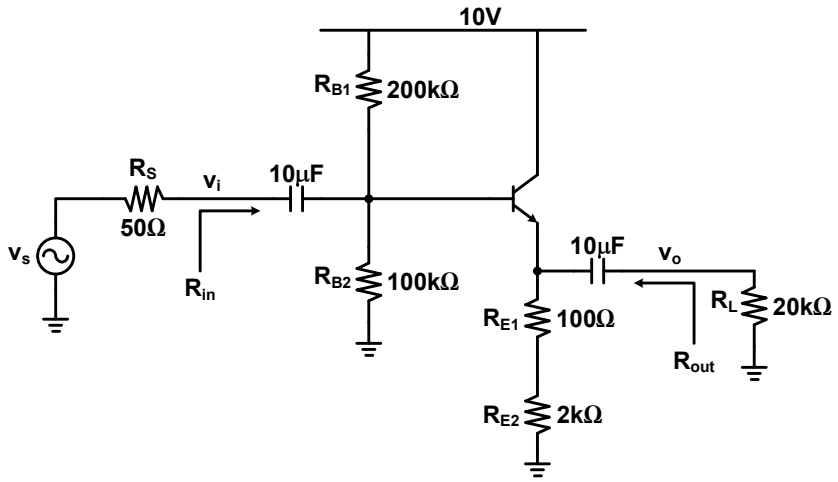
1. **(25 points – 15pts calc., 10pts Multisim)** BJT DC Operating Points and AC small signal parameters.
a) For the BJT circuit below, calculate the DC values for V_C, V_B, V_E, I_C, I_B, and I_E. Compute the AC small signal parameters g_m, r_π, r_e. Assume the transistor β=150, V_{BE}=0.7V, and V_{th}=25.9mV.
b) Verify the DC operating points in Multisim.



2. **(25 points – 15pts calc., 10pts Multisim)** Common Emitter Amplifier.
a) For the common emitter amplifier below, calculate the small signal gain $A_v=v_o/v_i$ (from the transistor base to the output node), the input resistance R_{in}, the output resistance R_{out}, and the overall voltage gain $G_v=v_o/v_s$ (from the voltage source to the output node). Assume that the capacitors act as AC shorts and that the transistor's r_o is infinite (can be neglected). Note, you can use the small signal parameters that you solved for in Problem 1.
b) Simulate in Multisim. Plot the magnitude in dB (or dbΩ) of A_v, G_V, R_{in}, and R_{out} versus frequency from 10Hz to 10MHz.



3. **(25 points – 15pts calc., 10pts Multisim)** Common Collector Amplifier.
Repeat parts a) and b) from Problem 2 for the common collector amplifier.



4. **(25 points – 15pts calc., 10pts Multisim)** Common Base Amplifier.
Repeat parts a) and b) from Problem 2 for the common base amplifier.