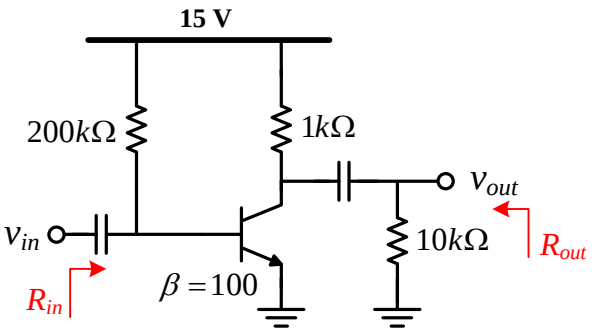
In the name of Allah, The compassionate, the merciful

Electronics 1, Assignment #7, Single-stage BJT amplifiers.

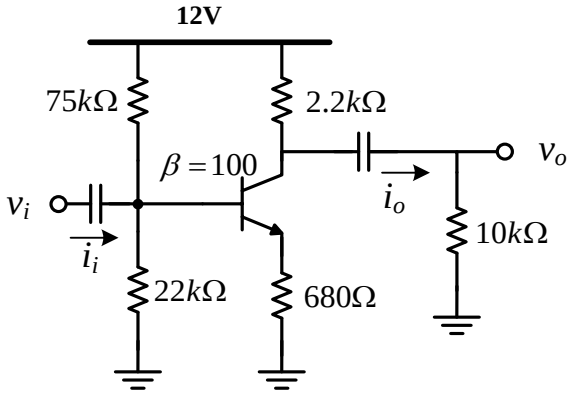
Due: Ordibehesht, 27th

Shahrood University of Technology

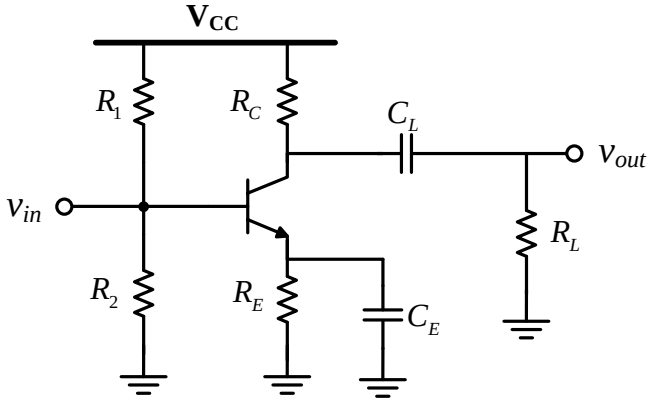
1. In the following circuit, determine the input resistance, R_{in}, output resistance, R_{out}, and the small-signal voltage gain, $A_v = v_o / v_i$.



2. In the following circuit, determine the current gain, $A_i = i_o / i_i$, and the voltage gain, $A_v = v_o / v_i$.

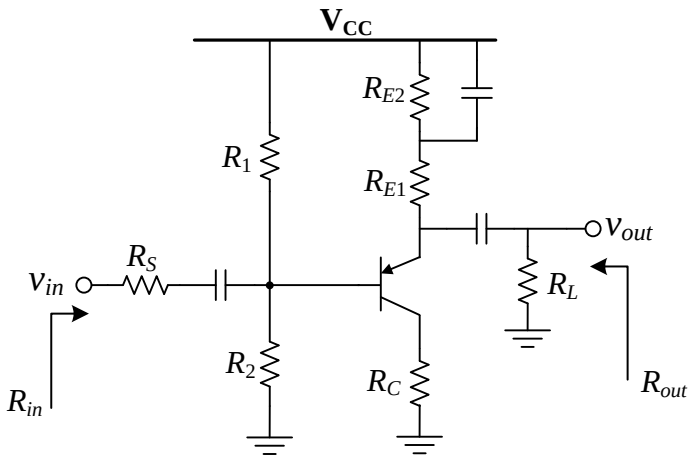


3. The small-signal voltage gain of the following circuit is supposed to be 48 and the DC voltage across R_C is 3 V. Determine the value of R_C.



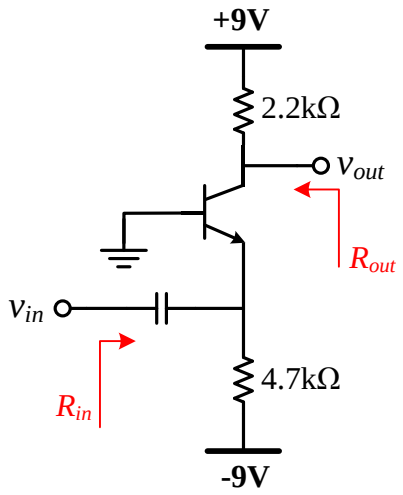
$$\begin{cases} V_{CE,sat} = 0V \\ V_T = 25mV \\ R_L = 1k\Omega \end{cases}$$

4. In the following circuit, determine the input resistance, R_{in}, output resistance, R_{out}, and the small-signal voltage gain, $A_v = v_o / v_i$.



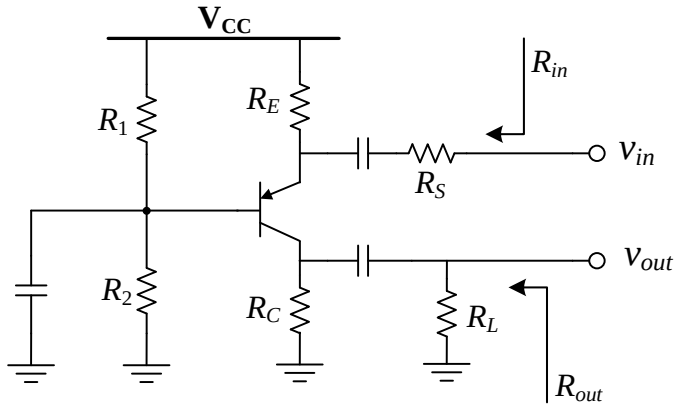
$$\begin{cases} R_S = 2k\Omega,\ R_1 = 3k\Omega,\ R_2 = 7k\Omega \\ R_{E1} = 1k\Omega,\ R_{E2} = 1.3k\Omega \\ R_C = 2k\Omega,\ R_L = 1k\Omega \\ |V_{BE,on}| = 0.7V,\ |V_{CEsat}| = 0.2V \\ V_A = \infty,\ V_T = 25mV,\ \beta = 100 \\ V_{CC} = 10V \end{cases}$$

5. Calculate the small-signal voltage gain, input resistance, and output resistance of the structure shown below.



$$\begin{cases} V_{BE} = 0.7V \\ V_{CEsat} = 0.2V \\ V_A = \infty \\ V_T = 25mV \\ \beta = 100 \end{cases}$$

6. In the following circuit, determine the input resistance, R_{in}, output resistance, R_{out}, and the small-signal voltage gain, $A_v = v_o / v_i$.

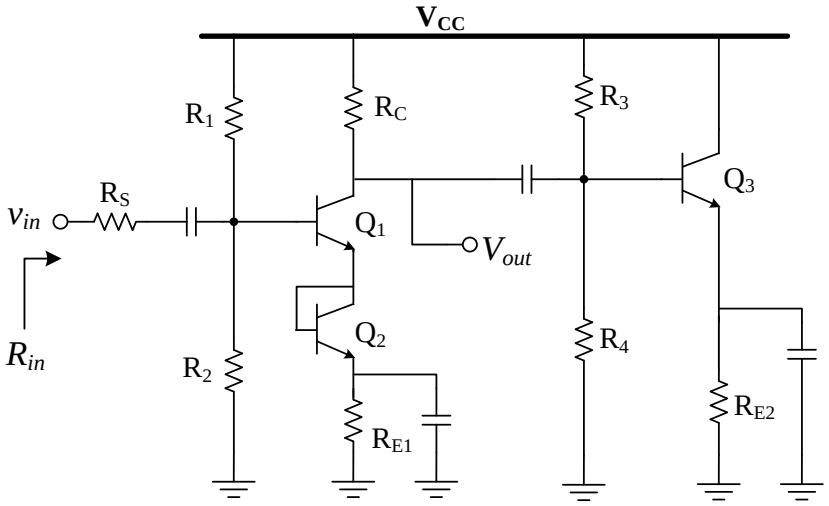


$$\begin{cases} R_S = 25\Omega,\ R_1 = 3k\Omega,\ R_2 = 7k\Omega \\ R_E = 2.3k\Omega,\ R_C = 2k\Omega,\ R_L = 2k\Omega \\ V_{EB,on} = 0.7V,\quad V_{ECsat} = 0.2V \\ V_A = \infty,\ V_T = 25mV,\ \beta = 100 \\ V_{CC} = 10V \end{cases}$$

7. a) Prove that the bias current of the transistor Q_1 is 1 mA. Assume that the transistor operates in F.A. region.

   b) Determine R_C so that V_{CE1}=3.3 V.

   c) Calculate the output voltage (V_{out}).



$$\begin{cases} V_{CC} = 10V \\ R_S = 1k\Omega \\ R_1 = 7.6k\Omega, R_2 = 2.4k\Omega \\ R_3 = R_4 = 20k\Omega \\ R_{E1} = 1k\Omega, R_{E2} = 17.2k\Omega \\ V_{BE,on} = 0.7V, V_{CE,sat} = 0.2V \\ \beta = 100,\ V_A = \infty \\ V_T = 25mV \\ v_{in} = 0.001 \times \sin(1000t) \end{cases}$$

Good luck – M.R. Ashraf