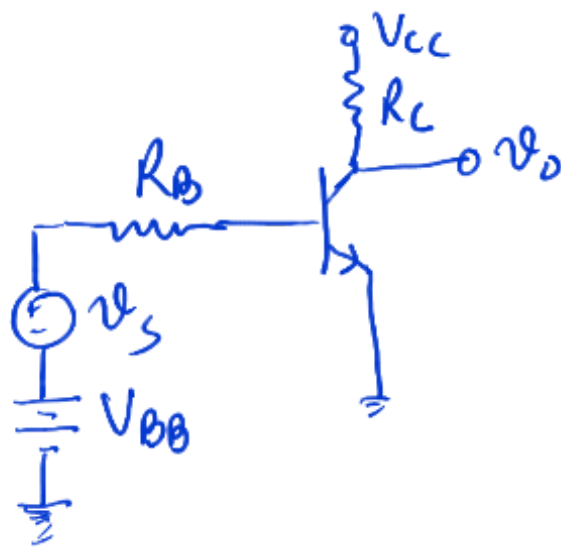
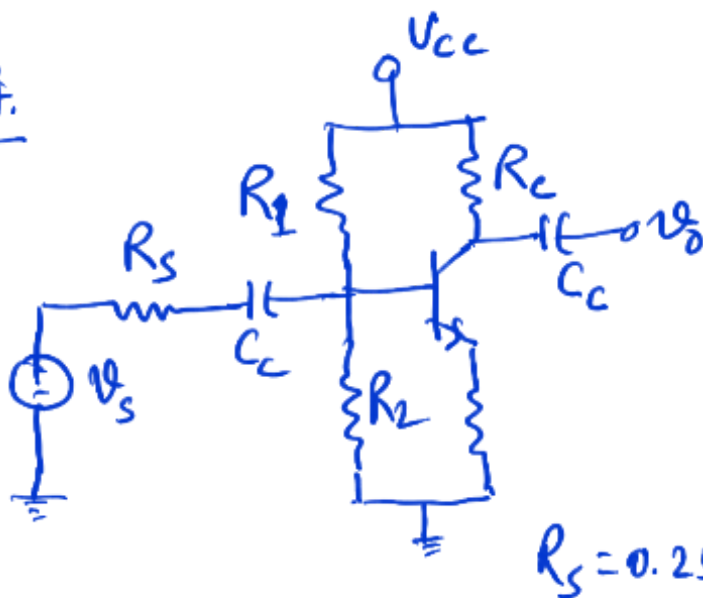


Tutorial questions

1. Determine the small-signal parameters g_m , r_π and r_o of a transistor with parameters $\beta = 180$, $V_A = 150\text{V}$ for bias currents of (i) $I_{CQ} = 0.5\text{mA}$ and (iii) $I_{CQ} = 2\text{mA}$. Assume $V_T = 26\text{mV}$.
2. The transistor parameters are $\beta = 125$ and $V_A = 200\text{V}$. A value of $g_m = 95\text{mA/V}$ is desired. Determine the required collector current and then find r_π and r_o .
3. For the given circuit, the transistor parameters are $\beta = 120$, $V_{BE(on)} = 0.7\text{V}$ and $V_A = 80\text{V}$. Other circuit parameters are $V_{CC} = 3.3\text{V}$, $V_{BB} = 1.10\text{V}$, $R_C = 4\text{k}\Omega$ and $R_B = 110\text{k}\Omega$. (a) Determine the hybrid- π parameters, (b) Draw hybrid- π equivalent circuit and obtain the small-signal gain $A_v = \frac{v_o}{v_s}$. (c) If the time varying output signal is given by $v_o = 0.5 \sin(100t)\text{V}$, what is $v_s(t)$?



Q4.



$$R_E = 0.25 \text{ k}\Omega$$

$$R_C = 4 \text{ k}\Omega$$

$$R_1 = 100 \text{ k}\Omega$$

$$R_2 = 25 \text{ k}\Omega$$

$$\beta = 120, V_{BE(on)} = 0.7 \text{ V}$$

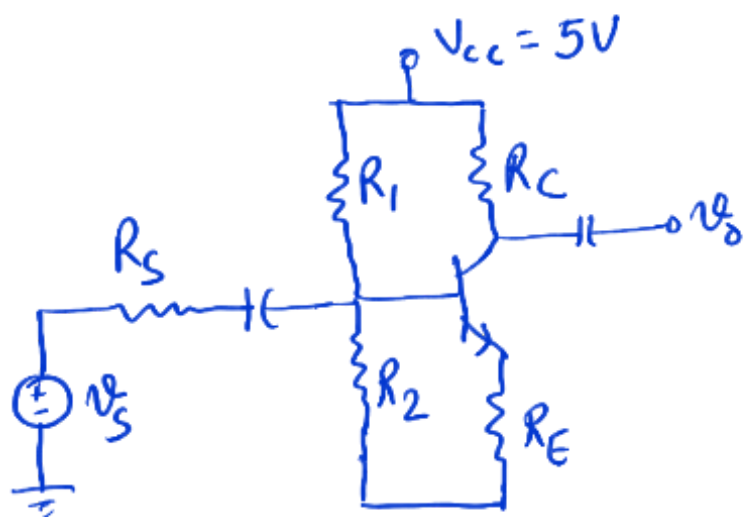
$$V_A = \infty, V_{CC} = 5 \text{ V}$$

$$R_S = 0.25 \text{ k}\Omega$$

- Draw hybrid- π equivalent circuit.
- Determine the quiescent values, I_{CQ} , V_{CEQ} , and find the small-signal parameters g_m , r_π , r_o and obtain the small-signal voltage gain.
- Also calculate input resistance to base R_{ib} , input resistance to the amplifier R_i , output resistance of the amplifier R_o . Obtain the loading effect for the circuit.

- d. Repeat if β changes by 25%, estimate the change in voltage gain.

Q5.



Design a bias stable circuit for the parameters $\beta = 100$, $V_{BE(on)} = 0.7V$, $V_A = \infty$, $I_{CQ} = 0.5mA$, $V_{CEQ} = 2.5V$, and $A_v = -8$.

- Q6. Draw hybrid- π equivalent circuit for the following circuit. Obtain the small-signal gain for (i) $\beta = 75$, (ii) $\beta = 100$ (iii) $\beta = 125$. $R_{E2} = 1.1 R_{E1}$. Rest other parameters from Q4.

