Electronic Circuits and Systems (EEE211)

Course Work: Assignment−1

Deadline: 09-October-2024, 17:00 hours @ LMO

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1) Calculate the base, collector, and emitter currents and the C-E voltage for a common-emitter circuit shown in Figure. 1. The circuit parameters are: $V_{BB} = 2\ V, V_{CC} = 3.3\ V, R_C = 3.2\ k\Omega$, and $R_B = 430\ k\Omega$. The transistor parameters are $\beta = 150$ and $V_{BE} = 0.7\ V$. **[10 Marks]**

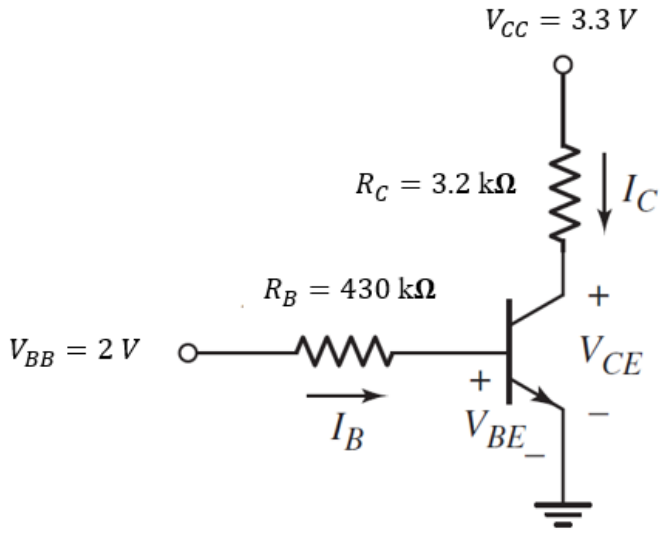

Figure. 1

2) Calculate the characteristics (I_C, V_{CE}) of a circuit including base and emitter currents, which consists of an emitter resistor shown in Figure. 2. The circuit parameters are annotated in the figure and the transistor parameters are: $\beta = 80$ and $V_{BE(on)} = 0.7\ V$. **[13 Marks]**

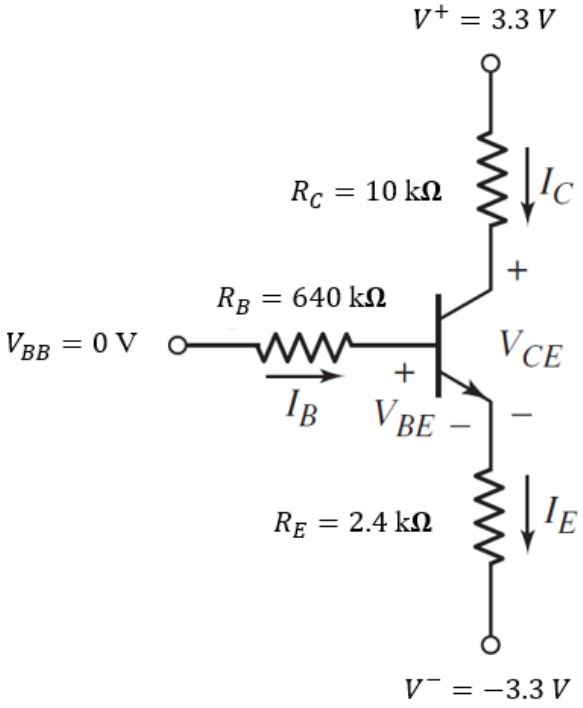

Figure. 2

3) For the circuit shown in Figure. 3, assume the circuit parameters are: $V_{CC} = 5\,V, V_{BB} = 1.025\,V, R_B = 100\,k\Omega$, and $R_C = 6\,k\Omega$. Consider the transistor parameters as $\beta = 150$, $V_{BE(on)} = 0.7\,V$, and $V_A = 150\,V$. (a) Calculate the Q-point values (I_{CQ}, V_{CEQ}) using DC analysis, (b) Determine the small-signal hybrid$-\pi$ parameters (r_π, g_m, r_o), (c) Find the small-signal voltage gain $A_v = V_o/V_s$. **[22 Marks]**

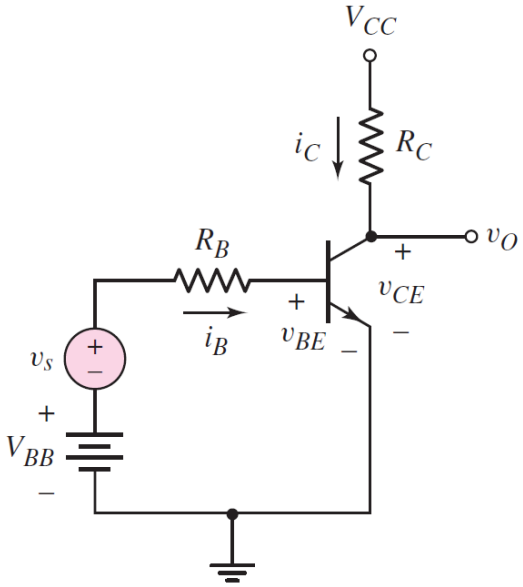

Figure. 3

4) For the circuit shown in Figure. 4, consider $R_E = 0.6\ k\Omega, R_C = 5.6\ k\Omega, \beta = 120, V_{BE(on)} = 0.7\ V, R_1 = 250\ k\Omega$, and $R_2 = 75\ k\Omega$. (a) Calculate the Q-point values (I_{CQ}, V_{CEQ}) using DC analysis, (b) Determine the small-signal hybrid$-\pi$ parameters $(r_\pi, g_m,\ r_o)$, (c) Find the small-signal voltage gain $A_v = V_o/V_s$, assuming $V_A = \infty$, (d) Determine the input resistance looking into the base of the transistor. **[25 Marks]**

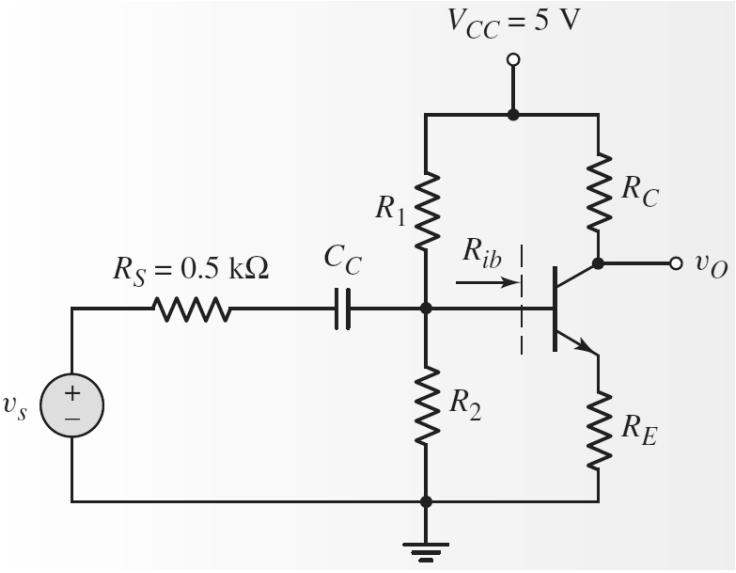

Figure. 4

5) For the circuit shown in Figure. 5, consider the circuit parameters as $V_{CC} = V_{EE} = 3.3\ V, R_S = 500\ k\Omega, R_L = 6\ k\Omega, R_B = 100\ k\Omega, R_E = 12\ k\Omega$, and $R_C = 12\ k\Omega$. The transistor parameters are: $\beta = 120, V_{BE(on)} = 0.7\ V$, and $V_A = \infty$. (a) Calculate the Q-point values (I_{CQ}, V_{CEQ}) using DC analysis, (b) Determine the small-signal hybrid$-\pi$ parameters $(r_\pi, g_m,\ r_o)$, (c) Find the small-signal voltage gain $A_v = v_o/v_s$, (d) Find the small-signal current gain $A_i = i_o/i_i$, (e) Determine the input resistance R_i and output resistance R_o. **[30 Marks]**

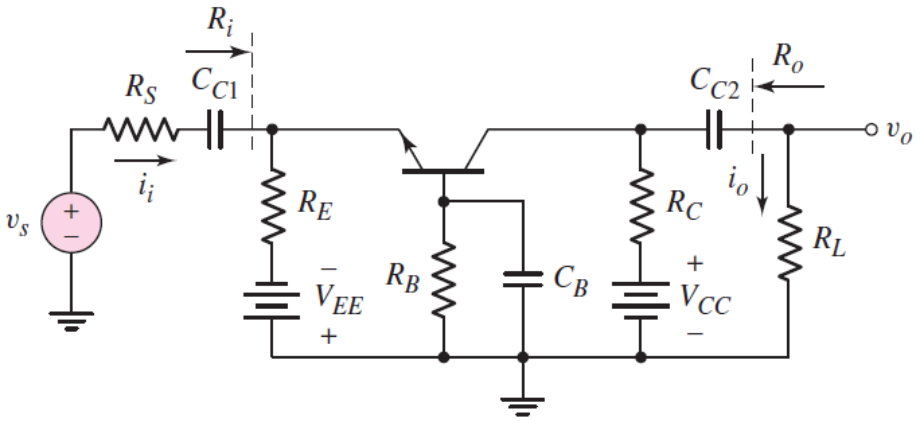

Figure. 5