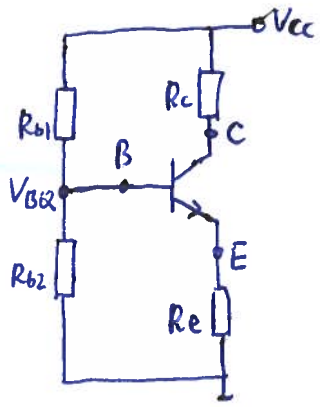
# Answers to practice exercise of lecture-4

a. DC circuit:




$$V_{BQ} \approx \frac{R_{b2}}{R_{b1}+R_{b2}} \cdot V_{cc} = 4.21\,V$$

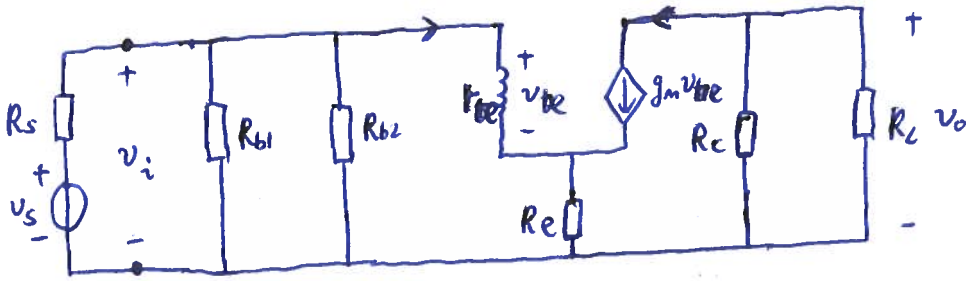
$$I_{CQ} \approx I_{EQ} = \frac{V_{BQ} - V_{BEQ}}{R_e} = 1.755\,mA$$

$$V_{CEQ} = V_{cc} - I_{CQ} R_c - I_{EQ} R_e \approx V_{cc} - I_{CQ}(R_c + R_e) = 6.69\,V$$

$$I_{BQ} = \frac{I_{CQ}}{\beta} = \frac{1.755\,mA}{80} = 21.9\,\mu A$$

Q (21.9 μA, 1.755 mA, 6.69 V)

b.




$$R_i = R_{b1} // R_{b2} // [r_{be} + (1+\beta) R_e] \approx 13.5\,k\Omega$$

$$r_{be} = \frac{\beta}{g_m}, \quad g_m = \frac{I_{CQ}}{V_T} = \frac{1.755\,mA}{26\,mV} = 0.0675\,S$$

$$r_{be} = 80 / 0.0675 \approx 1185\,\Omega = 1.185\,k\Omega$$

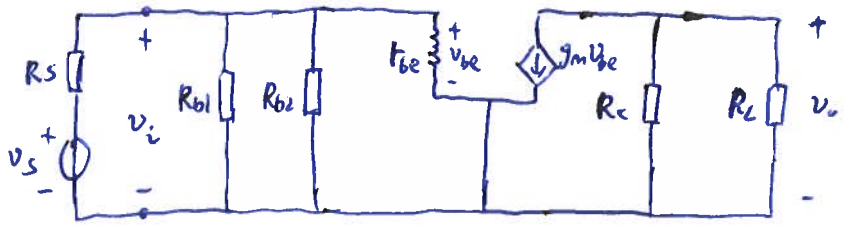
$$R_o \approx R_c = 3.3\,k\Omega$$

$$A_v = \frac{v_o}{v_i} = -\frac{\beta \cdot (R_c // R_L)}{r_{be} + (1+\beta) R_e} \approx -1.05$$

c. if a capacitor is parallel with $R_e$, ~~recalculate a~~.

the Q point is the same as the capacitor is regarded as open in DC circuit.

recalculate (b). since capacitor is regarded as short for AC circuit.




$R_i = R_{b1} // R_{b2} // r_{be} \approx 1.1\ k\Omega$

$R_o = R_c = 3.3\ k\Omega$

$$A_v = \frac{v_o}{v_i} = -\frac{\beta \cdot (R_{b1} // R_{b2})}{r_{be}} \approx -995$$