Chapter 5 #4, 5, 11

Note Title 10/19/2012

4) What is the reactance of a 10-μF capacitor at a frequency of 1 kHz? For networks in which the resistor levels are typically in the kilohm range, is it a good assumption to use the short-circuit equivalence for the conditions just described? How about at 100 kHz?

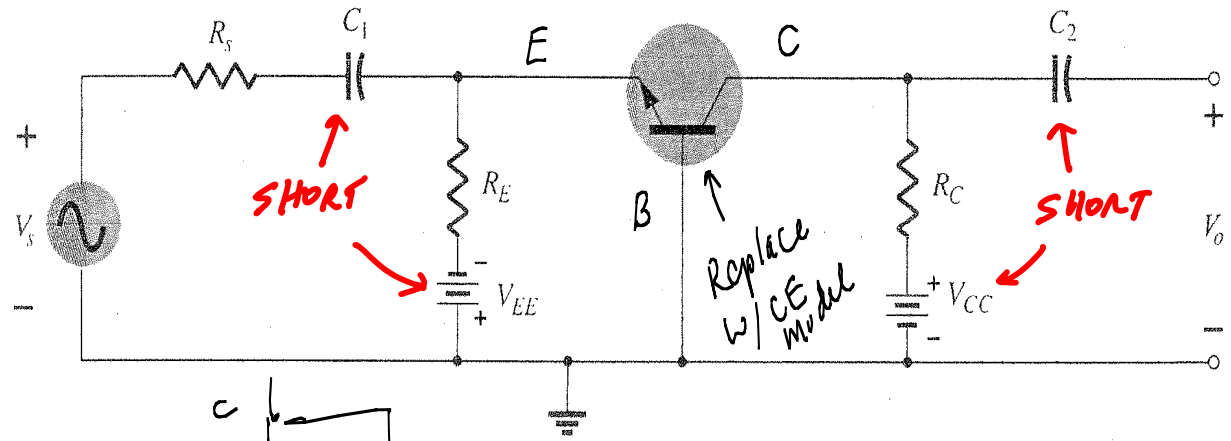
X_C is reactance $\quad X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \frac{1}{2\pi(1\text{kHz})(10\mu\text{F})} = 15.92\Omega$

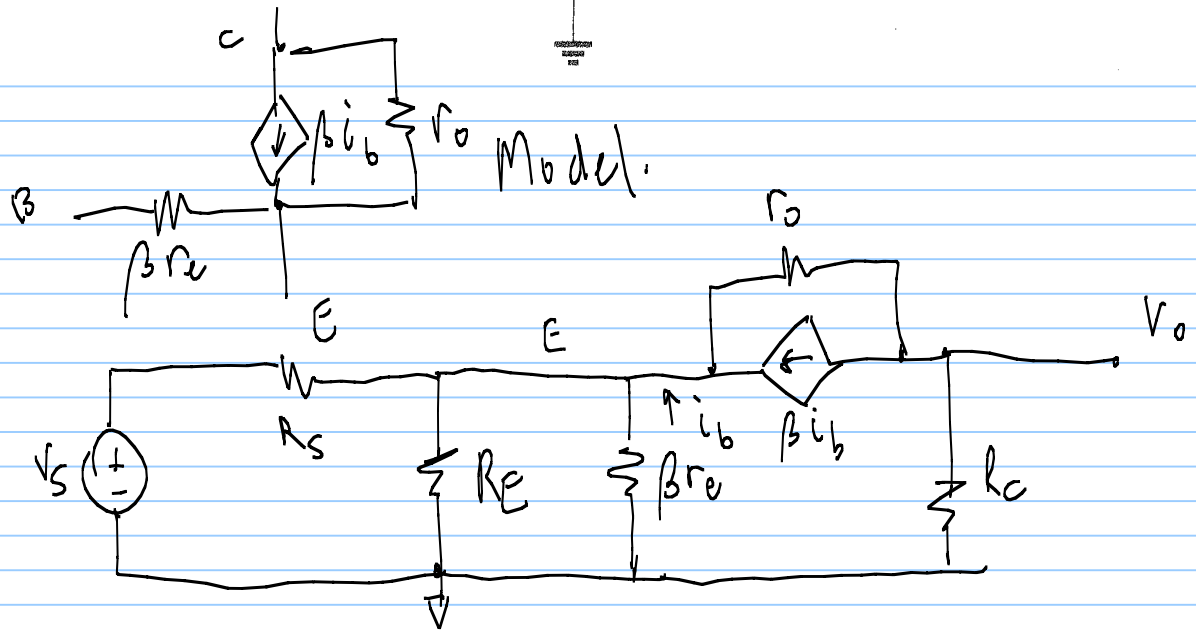
Yes, ~1.5% of the resistor values.

X_C @ 100kHz $\Rightarrow X_C = \frac{1}{2\pi(100{,}000)(10\mu\text{F})} = 0.1592\Omega$ less than 1Ω

totally insignificant

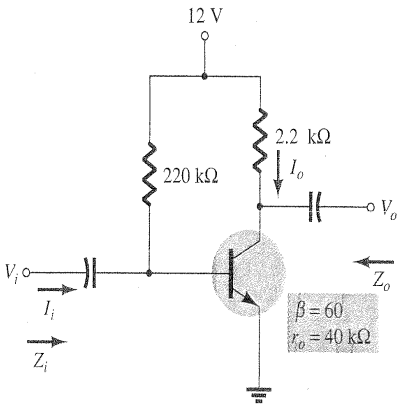
5) Sketch the ac equivalent of the common base circuit. Use the model in 5.16.

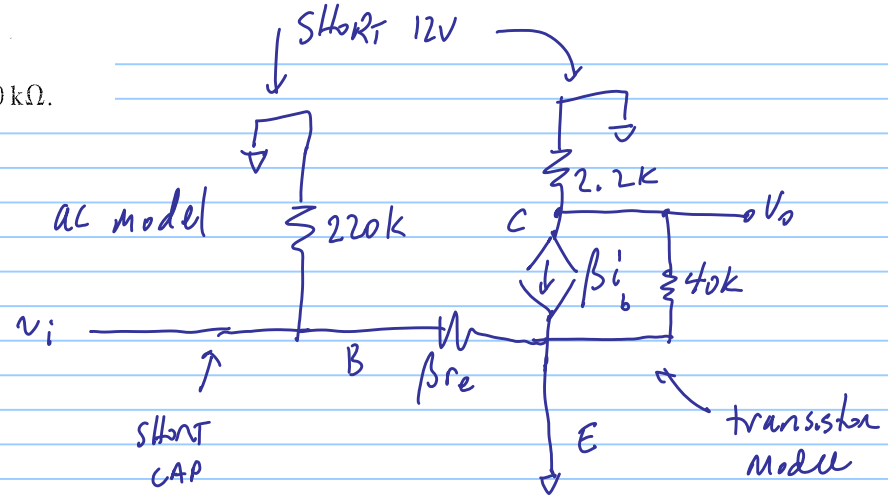




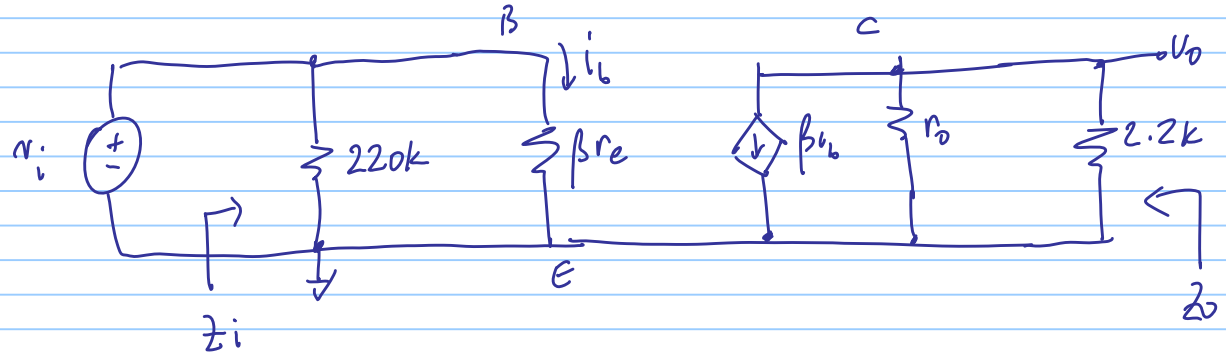
11)

a. Determine Z_i and Z_o.
b. Find A_v.
c. Repeat parts (a) and (b) with $r_o = 20\ \text{k}\Omega$.





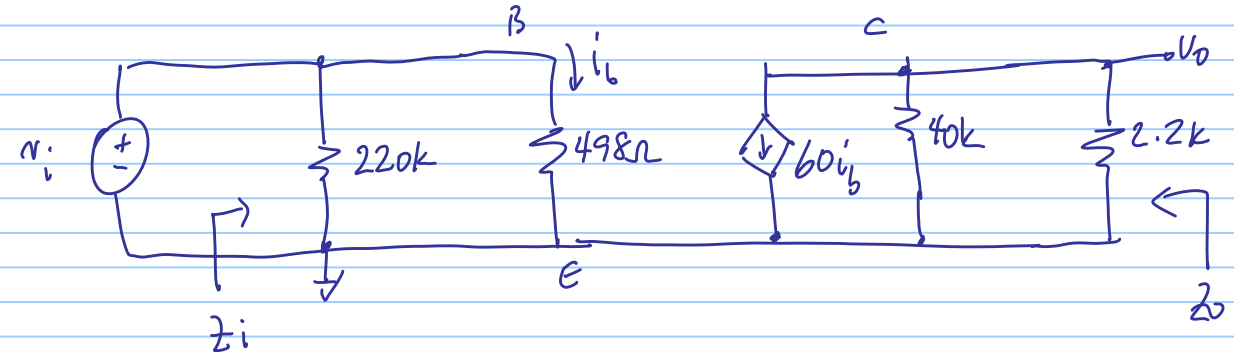
clean up.



DC analysis to find I_E & then r_e.

$$I_B = \frac{12 - 0.7}{220k} = 51.36\mu A \qquad I_E = (\beta+1) I_B = 3.133mA \qquad r_e = \frac{0.026}{I_E} = 8.3\Omega$$

$$\beta r_e = 498\Omega$$



$$Z_i = R_B \| \beta r_e = 220k \| 498\Omega = 492\Omega \qquad Z_o = R_C \| r_o = 40k \| 2.2k = 2.09k$$

$$A_V = \frac{-R_C \| r_o}{r_e} = \frac{-40k \| 2.2k}{8.3} = -251$$

c) Repeat w/ $r_o = 20k$

Z_i unchanged. 492Ω

$Z_o = 2.2k \| 20k = 1.98k$

$$v_o = \frac{(20k \| 2.2k)}{8.3} = -238$$