EE101

Tutorial 4 (30-AUG-2013)

1. (a) In the two circuits shown in Figure for Problem 1(a), the transistors have β=100. Assume V_{BE}=0.7 V when the B-E junction is forward biased and V_{CE}=0.6 V if the C-E junction is forward biased.
Find the Q-point for the transistors in (a) and (b), i.e. V_{CE}, I_C and I_B

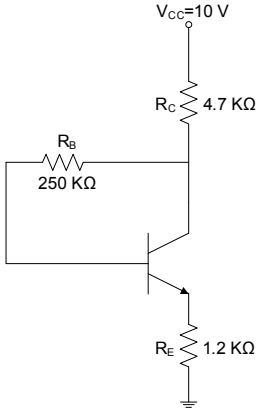

Figure for Problem 1(a)

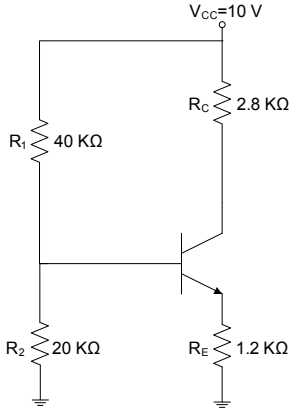

Figure for Problem 1(b)

(b) In the circuit of Figure for Problem 1(b), R_1 is changed to be 20KΩ while everything else remains the same. What will be the state of the transistor in this case?

2. For the network given in the Figure for Problem 2

(a) Calculate the time-constant τ

(b) Compare the half period of the applied signal to 5τ

(c) Sketch v_o

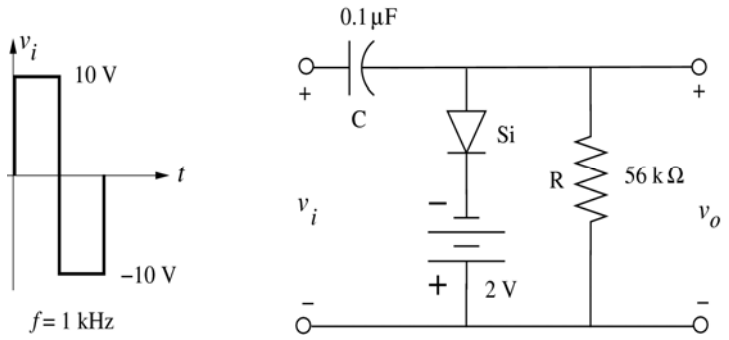

Figure for Problem 2

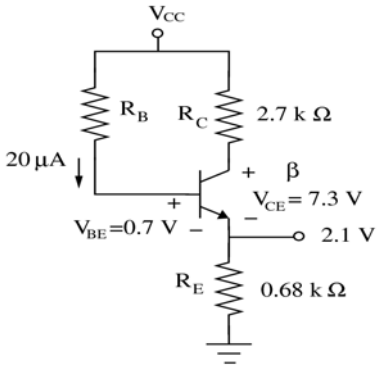

Figure for Problem 3

3. Given the transistor circuit in Figure for Problem 3 and the information provided in that, determine

(a)β (b) V_{CC} (c) R_B

4. A voltage source of $e(t) = 141\sin(\omega t)$ is applied a circuit with two parallel branches. The currents in the two brances are:

$$i_1(t) = 7.07\sin(\omega t - \pi/3), \text{ and } i_2(t) = 10\sin(\omega t + \pi/6)$$

(a) Calculate the total power supplied by the source.

(b) Express the voltage and currents in phasor forms and calculate,

- the total current supplied by the source
- the apparent power of the whole circuit, and
- the power factor of the whole circuit

(c) Write the expression for the total current $i_T(t)$

(d) Draw the phasor diagram showing the voltage and all the currents.

5. A voltage source $v(t) = V_m\sin(\omega t)$ is connected to a series RLC circuit. Given that L=4 H and C=1 F. For this circuit it is found that the power factor is $\frac{1}{\sqrt{2}}$ at a frequency which is two times the frequency at which current in the circuit becomes maximum. Determine R.