EE101
Tutorial 5 (13-SEPT-2013)

1. Consider the transistor amplifier shown in Fig. for Problem 1, assuming that the capacitors are large enough to be ignored (short-circuited) for AC analysis. The transistor is assumed to have β=120 and the output resistance r_O of the transistor can be ignored. Assume V_T=26 mV.

(a) For this amplifier, choose R_C such that a voltage gain of $A_V=v_O/v_S$= -160 can be provided.

(b) For this choice of R_C, what is the Q-point of the transistor?

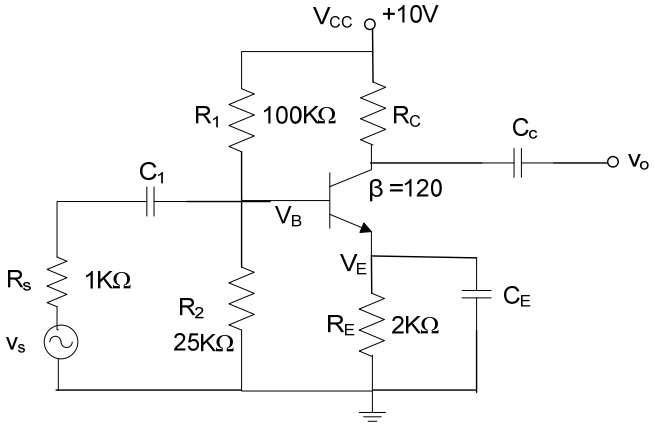

Fig. for Problem 1

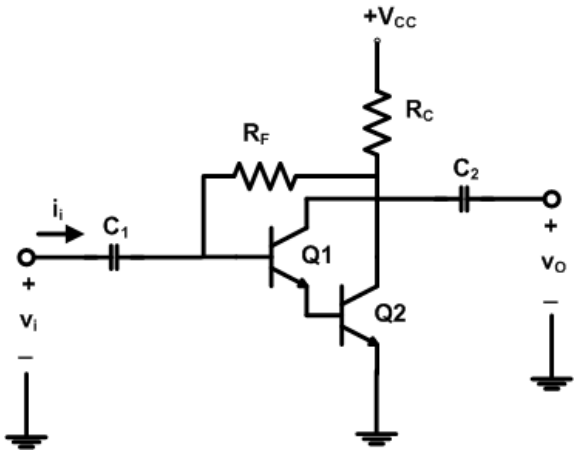

Fig. for Problem 2

2. Consider the amplifier circuit shown in Fig. for Problem 2. Assume that the two transistors are identical and that both the transistors operate in the active region with identical values of β. For Q1, you are given that r_e=r. Neglect r_O of the two transistors. You can also assume that r<<R_F, and R_C<<R_F.

(a) What is the r_e of Q2?
(b) Draw the small signal equivalent circuit for the amplifier.
(c) Find the **Voltage Gain $A_V = v_O/v_i$** of the amplifier**.**
(d) Find the **Input Impedance $Z_i = v_i/i_i$** of the amplifier.

3. For the transistor circuit given in the Fig. for Problem 3:

(a) Does V_C increases or decreases if R_B is increased?

(b) What happens to the saturation current if β is increased?

(c) Does the emitter current increases or decreases if V_{CC} is reduced?

(d) What happens to V_{CE} if the transistor is replaced by one with smaller β ?

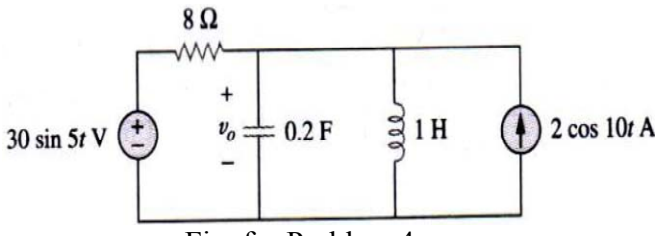

Fig. for Problem 4

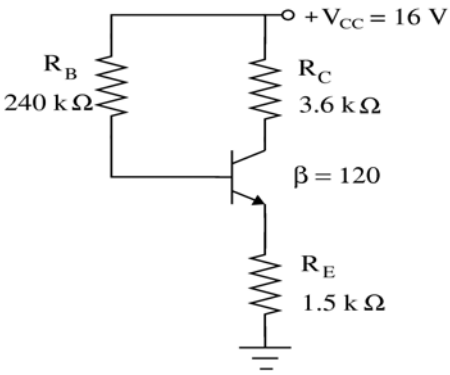

Fig. for Problem 3

4. Find the voltage *v*0 in the circuit shown in Fig. for Problem 4. (Note that the two sources have two different frequencies)

5. In the circuit shown in Fig. for Problem 3, the applied voltage is $e(t) = 141\sin 314t$.

a. Find the current I supplied by the source in phasor format.
b. Find the voltages across terminals a & b, and b & c in phasor formats.
c. Draw the phasor diagram showing E, I and V_{ab} and V_{bc}.
d. Calculate the complex power supplied by the source.
e. Calculate the powers absorbed by each circuit element and hence verify the result in (d).
f. Find the inductance of the inductor, and the capacitance of the capacitor.

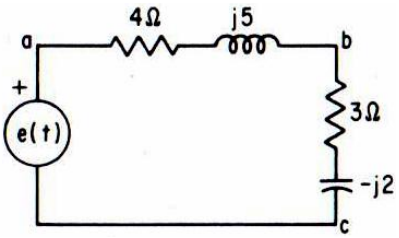

Fig. for Problem 5

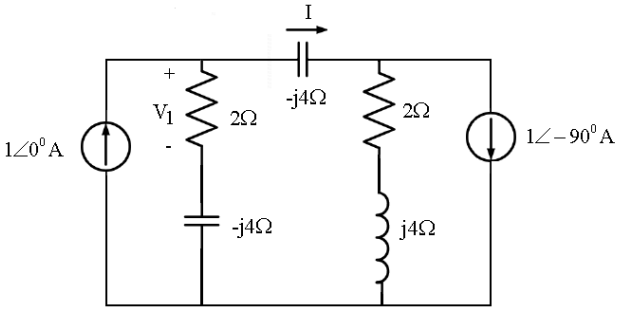

Fig. for Problem 6

6. For the circuit shown in Fig. for Problem 6, using Thevenin's theorem, determine the current I and then find the voltage V_1 across the $2\,\Omega$ resistance as shown.

7. For the transistor network given in the Fig. for Problem 7,

(a) Find the base-emitter diode resistance r_e of the CE transistor model.

(b) Determine the input impedance Z_i and the output impedance Z_o of the network.

(c) Calculate the voltage gain A_v of the network.

(d) Determine the effect of the output resistance $r_o = \mathbf{30}\,k\Omega$ on A_v.

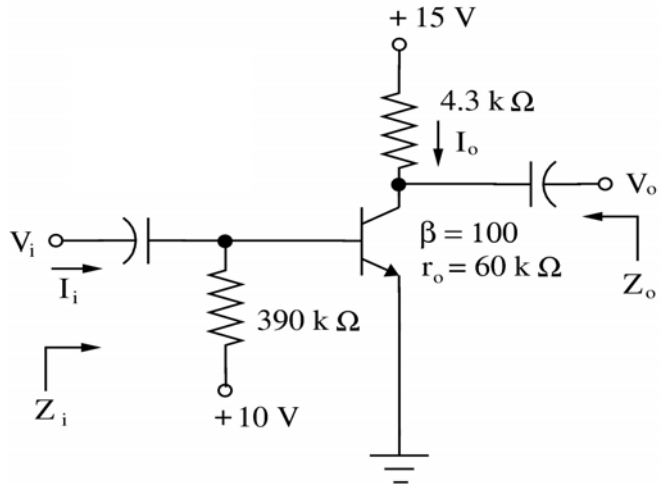

Fig. for Problem 7