Sheet(2): BJT AC Analysis

1- For the circuits shown on Figure 1, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

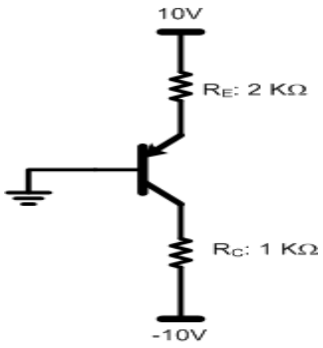

Fig 1

2- For the circuits shown on Figure 2, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

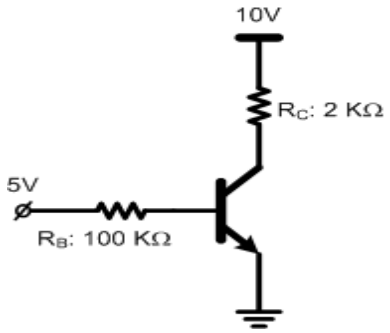

Fig 2

3- For the circuits shown on Figure 3, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

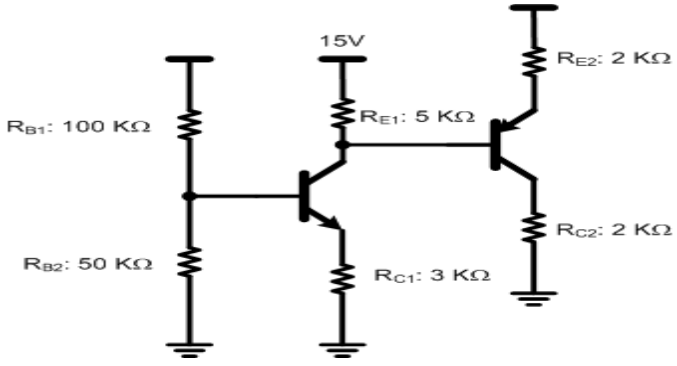

Fig 3

4- For the circuits shown on Figure 4, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

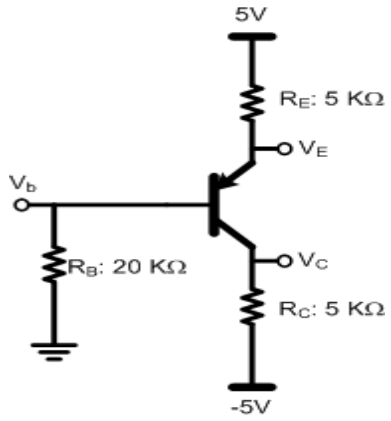

Fig 4

5- For the previous problem 4 determine:
   a) The DC load line and its graphical solution.
   b) The AC load line and compare it with the DC load line.

6- For the circuits shown on Figure 5, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

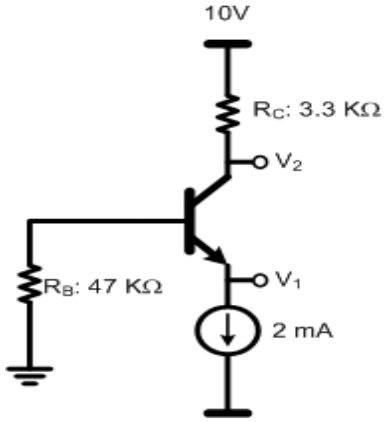

Fig 5

7- For the circuits shown on Figure 6, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

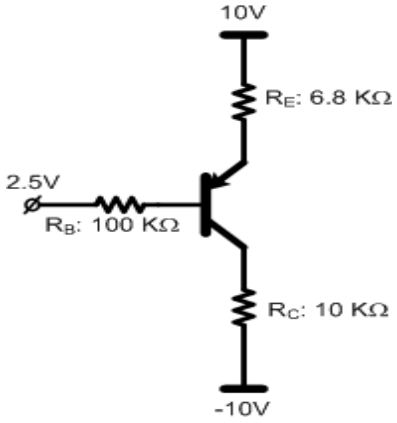

Fig 6

8- For the circuits shown on Figure 7, draw the equivalent AC circuit model. Denote on your schematic the values of r_π and r_o . (β = 100, VA = 100 V)

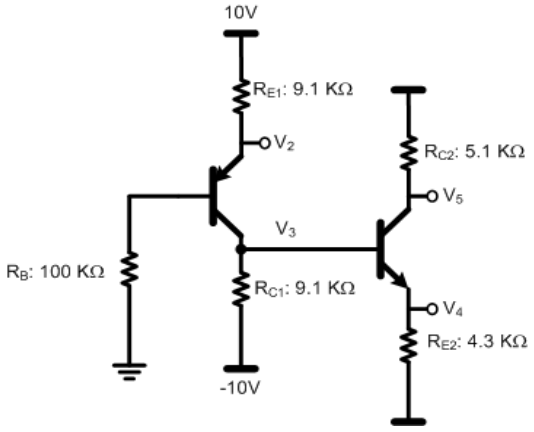

Fig 7

9- For the previous problem 8 determine:

c) The DC load line and its graphical solution.
d) The AC load line and compare it with the DC load line.

10- For the circuit shown in figure 8:

i. Find the values of R_E, R_C, R_{B1} and R_{B2}, given that I_E = 1mA, V_{CE} = 2.5V, R_E=R_C [*Hint: take R_{B2} = 10 kΩ*]

ii. Draw the equivalent AC circuit model and calculate gm, r_π

iii. Assuming all capacitors open circuit and (r_s=0 , R_L=1 *k*Ω), Find the Common emitter A_v , R_{in} and R_{out} in the two cases:

1. SW is short circuit.
2. SW is open circuit

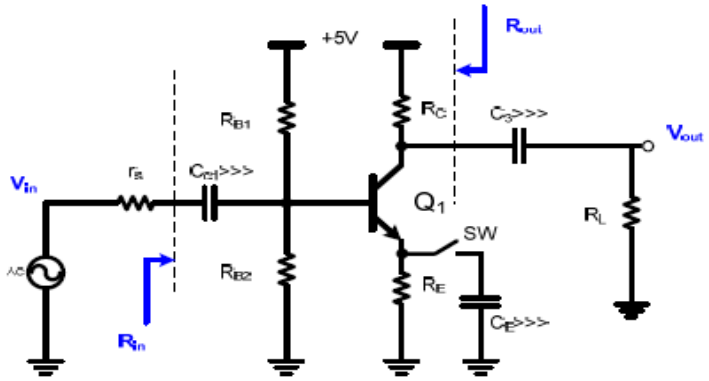

Fig 8

11- For the previous problem 10 determine:

e) The DC load line and its graphical solution.
f) The AC load line and compare it with the DC load line.

12- Analyze the transistor amplifir shown in figure 9 to determine its voltage gain

Assume β = 100

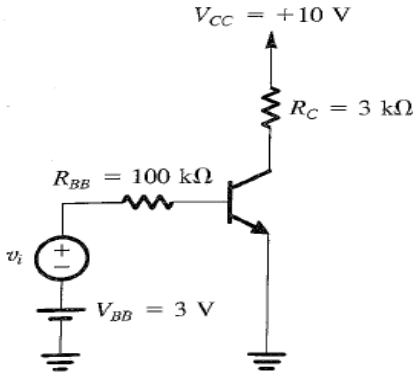

Fig 9

13- Analyze the transistor amplifir shown in figure 10 to determine its voltage gain.

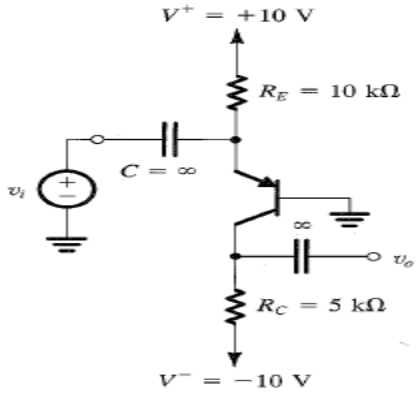

Fig 10

14- For the circuit shown in Fig. 11:

i. Draw the equivalent AC circuit model, given β = 100, g_m = 40mS, r_π = 2.5kΩ and r_o=100kΩ

ii. Find the voltage gain ($A_V = V_o/V_i$) and current gain ($A_I = i_L/i_s$).

iii. Find R_{in} and R_{out}

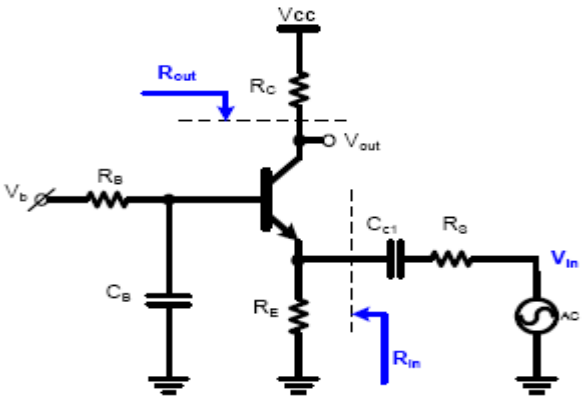

Fig 11

15- For the circuit shown in Fig. 12 :

i. Draw the equivalent AC circuit model, given β = 100, Vc c = 12v, Vbe = 0.7v, Rc = 6kΩ, Rb = 50 kΩ& Vbb = 1.2 v
ii. Find the voltage gain ($A_V = V_o/V_i$)
iii. Find R_{in} and R_{out}

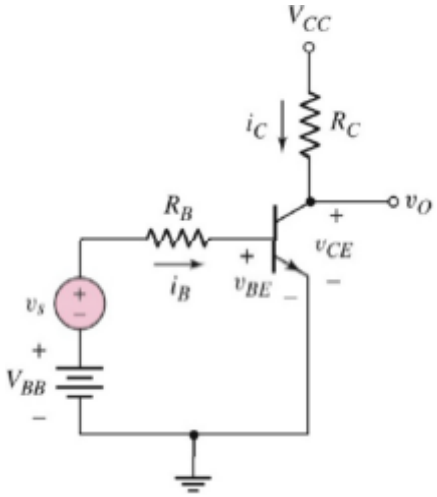

Fig 12

16- For the previous problem 15 determine:
g) The DC load line and its graphical solution.
h) The AC load line and compare it with the DC load line.

17- Determine the small-signal voltage gain, input resistance, and output resistance of the circuit shown in attached Figure 13. Assume the transistor parameters are: β=100, VBE(on) =0.7V, and VA=100V

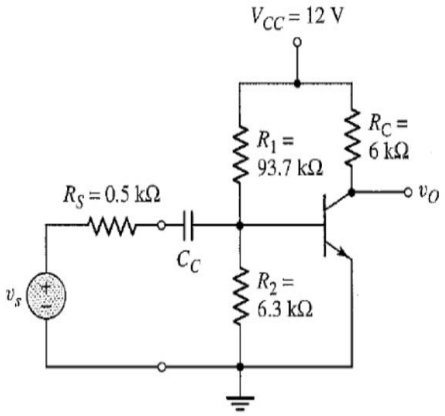

Fig 13

18- For the previous problem 17 determine:
a) The DC load line and its graphical solution.
b) The AC load line and compare it with the DC load line.

19- In the figure 14, let β=150,V_A=200V, V_{CC}=7.5V, $V_{BE(on)}$=0.7V, R_C=15KΩ, R_B=100kΩ, and V_{BB}=0.92V

a) Determine the small-signal hybrid- parameters r_π, g_m, and r_0

b) Find the small-signal voltage gain A_v

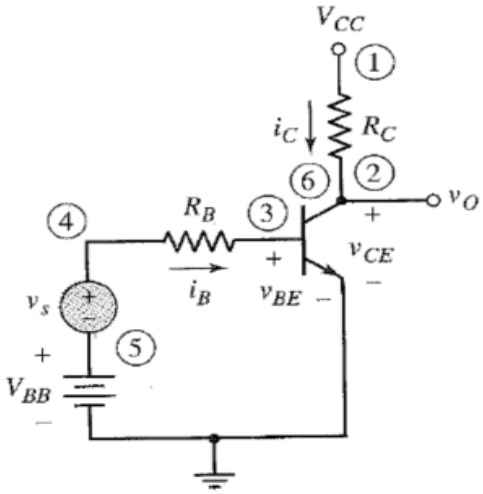

Fig 14

20- For the previous problem 8 determine:

a) The DC load line and its graphical solution.
b) The AC load line and compare it with the DC load line.