Tutorial #05

AC analysis of the transistor:

1. For a given circuit in Fig.1
   a) Determine the lowest frequency (in Hz) of ac signal at which good coupling exist.
   b) What would be the lowest frequency (in Hz) when the load resistance is reduced to 1kΩ?
   c) What would be the lowest frequency (in Hz) when the capacitor is changed to 100μF?
   d) What would be the choice of resistor and capacitor if you would like to couple ac signal at 100Hz?
2. For a given circuit in Fig.2
   a) Discuss the condition at which terminal A appears to be ac ground.
   b) If R_1=600Ω and R_2=1kΩ, determine C for which terminal A appears to be ac ground.
   c) For R_1=2.2kΩ, R_2=10kΩ and C=220μF, determine the lowest frequency at which terminal A appears ac ground.
3. For the given VDB amplifier in Fig.3
   a) Draw dc equivalent circuit and determine I_B, I_E, I_C, V_B, V_C, V_E and V_{CE}. (Assume dc current gain is β_{dc} and V_{BE}=0.7V)
   b) Draw ac equivalent circuit considering (i) T-model of the transistor and (ii) π-model of the transistor.
   c) Determine the emitter ac resistance r_e' for R_1=10kΩ, R2=2.2kΩ, R_C=3.6kΩ, R_E=1kΩ and V_{CC}=10V.
   d) Using the result of (c) determine input impedance at base, i.e., $z_{in(base)}$. (use β=100)
   e) Determine the voltage gain Av, if R_L=10kΩ. [use the value of other elements from (c) and (d)]
4. For the given circuit in Fig.4
   a) Draw ac equivalent circuit. (use π-model of the transistor)
   b) Determine $z_{in(stage)}$.
   c) Determine v_{in}.
   d) Draw dc equivalent circuit and determine $r_e'$and hence calculate voltage gain A_v.
   e) Using the result of part (c) and (d) determine v_{out}.
5. For the given two stage amplifier in Fig. 5
   a) Draw dc and ac equivalent circuits.
   b) Determiner_e', $z_{in(stage)}$ and v_{in}.
   c) Calculate A_{v1}, A_{v2},and A_v.
6. For the given swamped amplifier in Fig.6, use T-model of the transistor to determine voltage gain A_v and $z_{in(base)}$.
7. Using ac equivalent circuit of Fig.7, determine the output voltage. (use β=200 and ignore r_e')

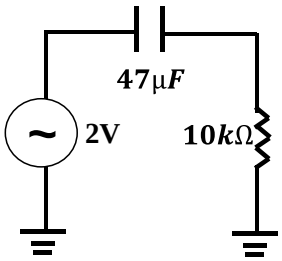

Fig.1

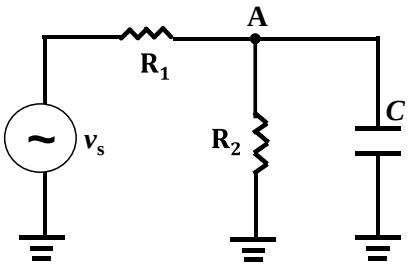

Fig.2

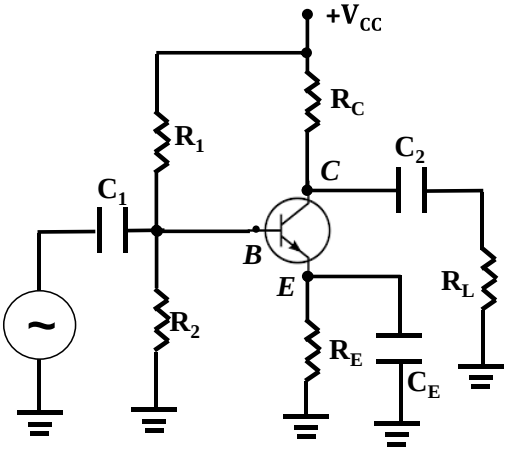

Fig.3

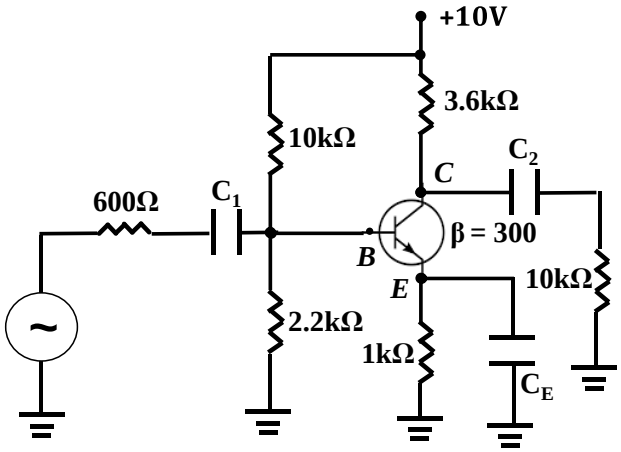

Fig.4

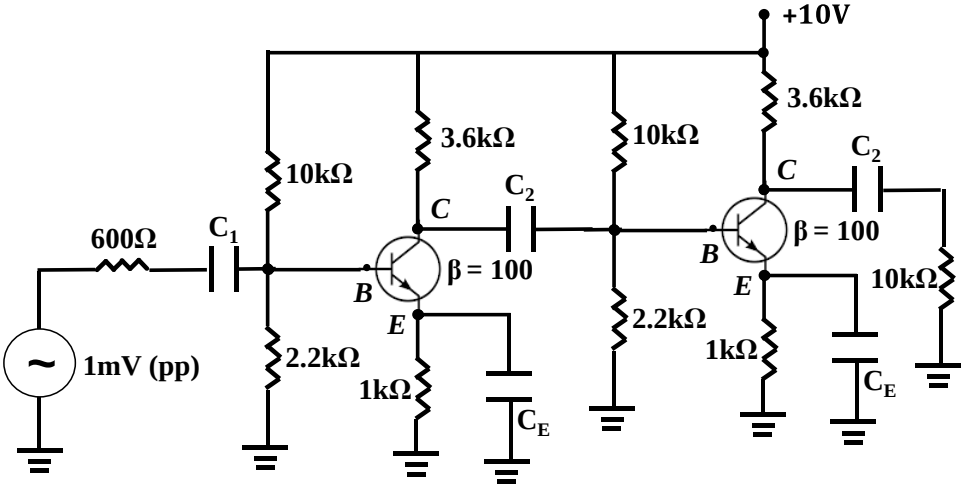

Fig.5

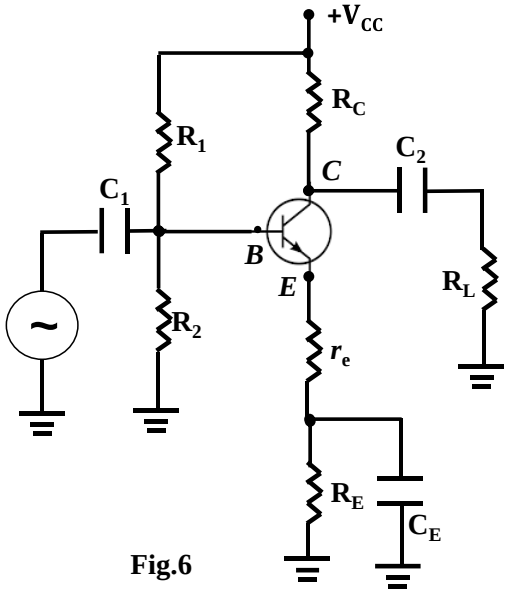
+V_CC
R_C
R_1
C_2
C
C_1
B
E
R_L
R_2
r_e
R_E
C_E

Fig.6

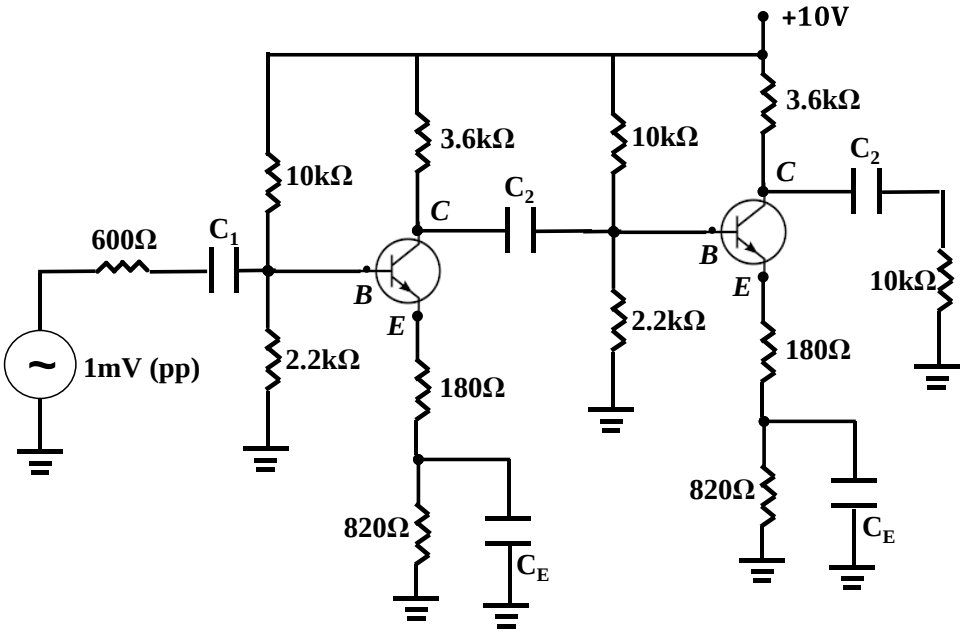
+10V
3.6kΩ
10kΩ
3.6kΩ
10kΩ
C_2
C
C_2
C
600Ω
C_1
B
B
E
E
10kΩ
2.2kΩ
2.2kΩ
180Ω
180Ω
1mV (pp)
820Ω
820Ω
C_E
C_E

Fig.7