# EE210: HW-9

Date: 12/03/2019

Unless stated otherwise, the BJT in the problems given below has the following characteristics

$I_S = 2.03 \times 10^{-15}\ A;\ \beta_F = 100;\ \beta_R = 1;\ V_A = \infty;\ r_{bb} = 200\Omega;\ V_T = 26mV;\ C_{jeo} = 1pF;\ C_{jco} = 0.5pF;$

$C_{jso} = 3pF;\ m = 0.5;\ V_{bi} = 0.85;\ \tau_F = 1ns$

(For simplicity, include $r_{bb}$ only in high frequency analysis and ignore $C_{js}$)

**Q.1** Figure 1 shows a common-collector amplifier schematic. Determine voltage gain, input and output resistances, maximum output voltage swing, lower and upper cutoff frequencies.

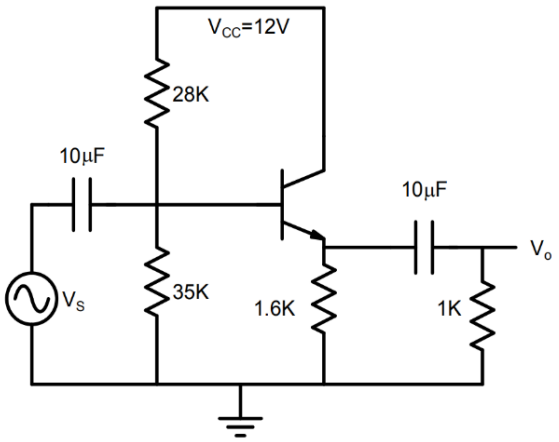


Fig. 1

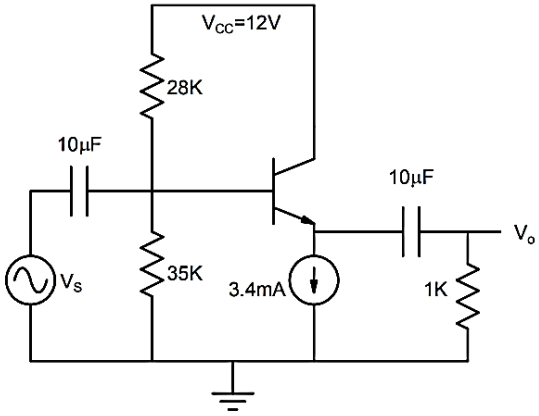


Fig. 2

**Q.2** Repeat the calculations for the amplifier shown in Fig. 2, which has a current source biasing.

**Q.3** Figure 3 shows one implementation of the current source biased CC amplifier. Determine the maximum output voltage swing that can be obtained? What is the flaw in the design of the amplifier?

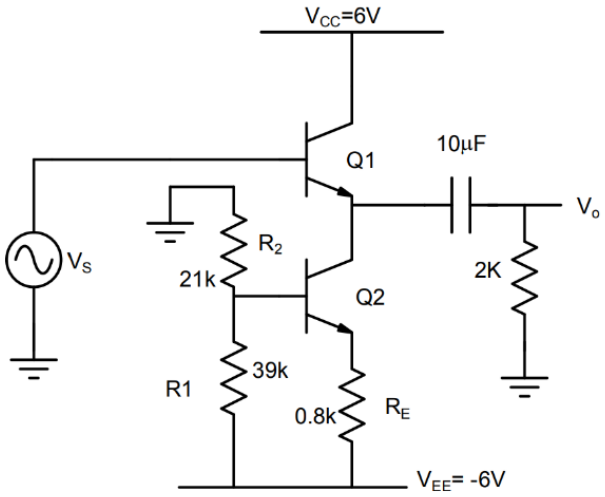


Fig. 3

**Q.4** Figure 4 shows a CE amplifier; whose voltage gain and upper cutoff frequency are 58 and 2MHz respectively. Show that use of the CC amplifier shown in Fig. 1 in the combination of CC-CE can result in significant improvement in both gain as well as upper cutoff frequency.

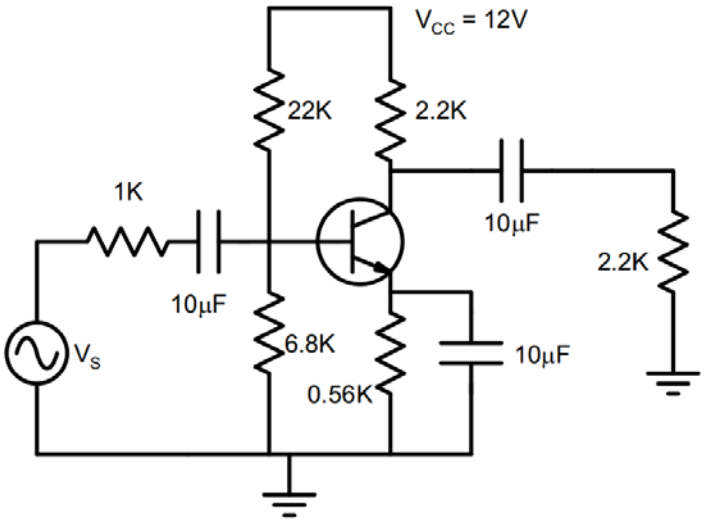


Fig. 4

**Q.5** Determine the values of resistors $R_B$ and $R_E$ to obtain a maximum output voltage swing of 1V first and then for 2V.

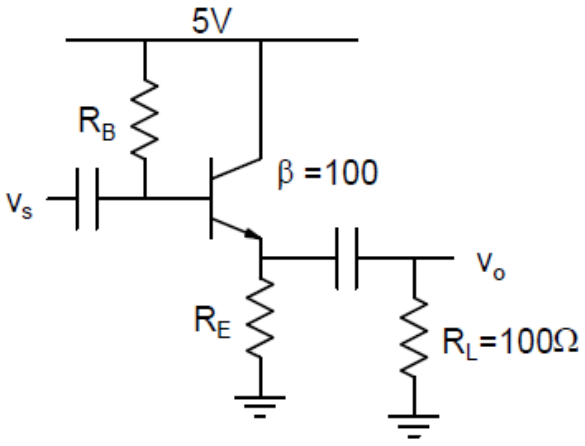


Fig. 5