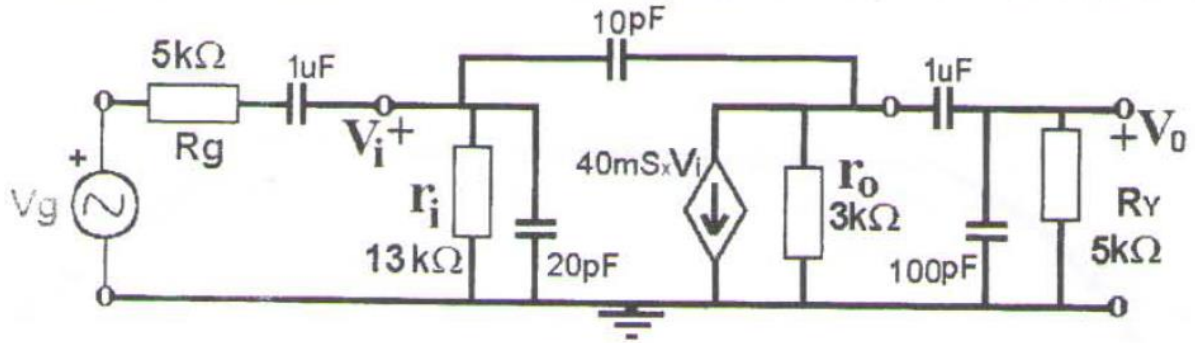


1-



AC equivalent circuit of the amplifier is given above.

a. Calculate V_o/V_g for mid frequencies.

S1a-vo/vg kazancının değerini orta frekanslar için bulunuz. (10P) (Denizce tek AYT'li'ler için)

$40mS \rightarrow g_m$ $\frac{V_o}{V_i} = -g_m r_o // R_y$ $\frac{V_o}{V_i} = -7.5$ $\frac{V_o}{V_g} = -54.1$

$\frac{V_i}{V_g} = \frac{r_i}{r_g + r_i} = \frac{13k}{13k + 5k} \rightarrow \frac{V_o}{V_g} = -54.1$

b. Calculate low frequency poles.

$f_{A1} = \frac{1}{2\pi \cdot 1\mu F \cdot (r_i + r_g)} \cong 9Hz$

$f_{A2} = \frac{1}{2\pi \cdot 1\mu F \cdot (r_o + R_y)} \cong 20Hz$

c. Calculate high frequency poles.

Miller etki

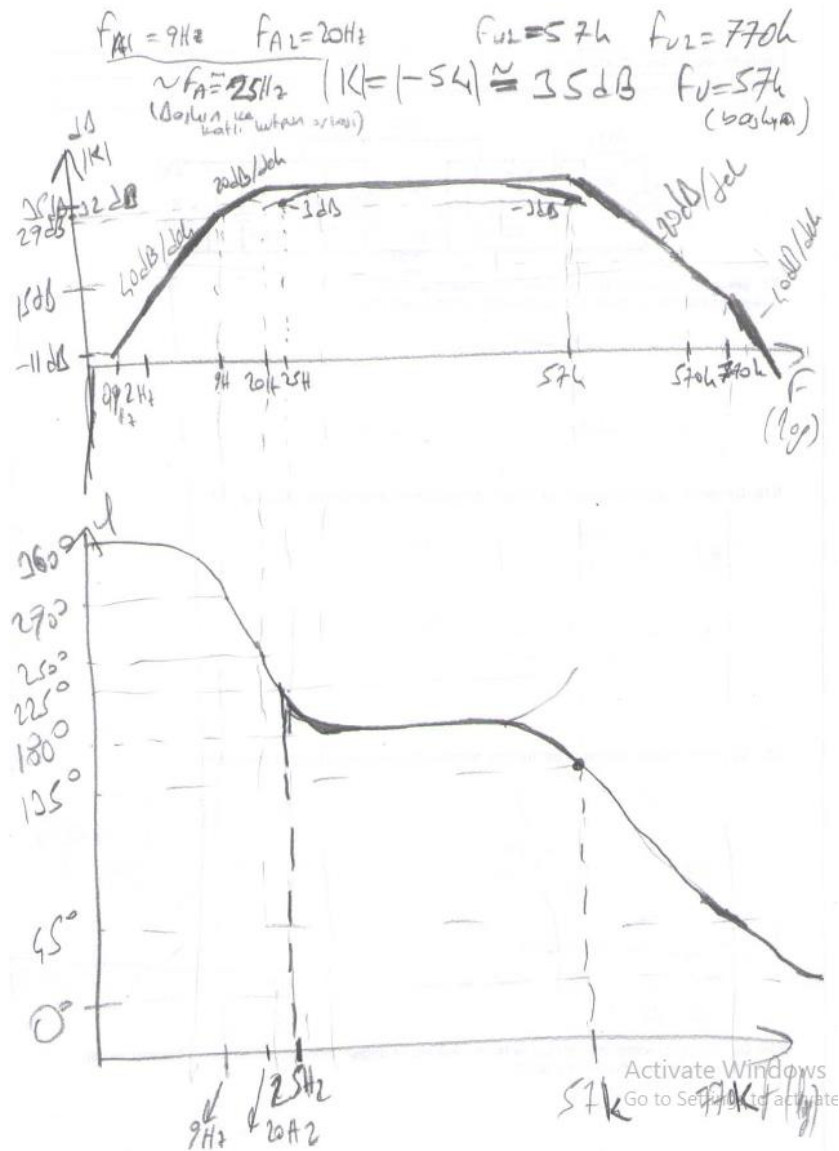
$13k // 20pF = 14pF(1 - \frac{1}{-7.5}) = 760pF$

$f_{u1} = \frac{1}{2\pi(760pF + 20pF)(13k // 5k)} \cong 57k$

$100pF(1 - \frac{1}{-7.5}) = 100pF$

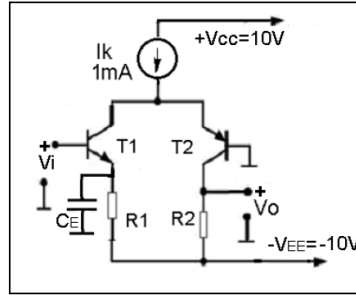
$f_{u2} = \frac{1}{2\pi(100pF + 100pF)(3k // 5k)} \cong 770k$

- d. Draw Bode plots (both magnitude and phase). Show the low and high frequency cutoff frequencies.



2- For the BJTs in figure, $\beta F=200$, $|V_{BE}|=0.6$ V, $V_T=25$ mV, $V_A=\infty$. In quiescent condition $V_i=0$ V, $V_{OQ}=V_{C2Q}=5$ V.

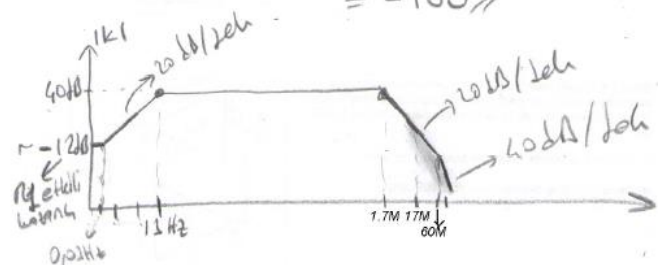
- Calculate R_1 and R_2 ($I_{CQ1} = 0.2$ mA)
- Calculate V_o/V_i and high cutoff frequency of V_o/V_i ($C_E=100$ μ F)
- Calculate high cutoff frequency ($C_{cb1}=5$ pF, $C_{be1}=30$ pF, $C_{cb2}=15$ pF, $C_{be2}=60$ pF)
- Draw Bode plots (both magnitude and phase) of V_o/V_i .



C-1- a) $I_{CQ1} + I_{EQ2} \approx I_{CQ1} + I_{CQ2} = I_{kA}$ (1)
 $I_{CQ2} = 0.8$ mA
 $V_{E1Q} = V_{iQ} - V_{BE1} = 0 - 0.6$ V = -0.6 V
 $V_{B2Q} = V_{E1Q} - (-V_{EE}) = 9.4$ V
 $I_{B2Q} \approx I_{CQ2} \rightarrow R_2 = 47$ k Ω
 $V_{OQ} = -5$ V $\rightarrow V_{E2Q} = -5$ V - (-10V) = 5 V
 $I_{E2Q} = I_{C2Q} = 0.8$ mA $\Rightarrow R_1 = 6.25$ k Ω

C-1- b) (2)
 $C_{2T} = C_{cb2} + C_{be2} = 85$ pF
 $C_{3T} = C_{cb2} = 15$ pF
 $R_{2T} = R_2 = \frac{V_T}{g_{m2}} (r_{c1} \text{ ihmal}) (r_2 \approx 31 \Omega)$
 $R_{3T} = R_2 (r_{c2} \text{ ihmal})$
 $f_{k1} = \frac{1}{2\pi C_{2T} R_{2T}} \approx 60$ kHz $f_{k2} = \frac{1}{2\pi C_{3T} R_{3T}} \approx 1.7$ MHz
 $f_{ust} = f_{k2} = 1.7$ MHz (baskın kutup)

d) $\frac{v_o}{v_i} = \frac{v_{c1}}{v_{b1}} \cdot \frac{v_{c2}}{v_{b2}} = -\beta_{m1} r_2 \cdot \beta_{m2} R_2$
 $= -100 //$



c) $C_{cb12} = C_{cb1} \cdot (1 - \frac{1}{\beta_{F1}}) \approx C_{cb1} \cdot 5 = 25$ pF
 $K_1 = -\beta_{m1} r_2 = -\frac{\beta_{m1}}{\beta_{m2}} = -\frac{1}{4}$
 $r_2 = \frac{1}{\beta_{m2}}$