رضاذینه بذر

۹۸۱٤۳ مش ۹

تمرین سری ۴ ع ذ ... سز

#1

$\beta = 100$

$V_{be,ON} = 0.7\,\bar{v}$

$V_\gamma = 0.5\,v$

i) $\begin{cases} Q_1 : off \\ Q_2 : ON \end{cases} \Rightarrow$
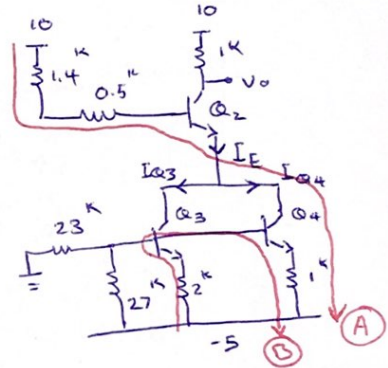
$\begin{cases} V_i = V_E + 0.7 \\ V_E = V_i - 0.7 + 0.5 \Rightarrow V_E = V_i - 0.2 \\ I_E = I_{Q3} + I_{Q4} \quad \text{**} \end{cases}$

KVL in $\boxed{A}$: $-10 + (1.4^k + 0.5^k)\cdot(101 I_E) + 0.7 + 0.5 + 1^k I_{Q4} = 0$

$\Rightarrow \boxed{191.9\, I_E + 1^k I_{Q4} = 8.8}$ (I)

KVL in $\boxed{B}$: $+5 - 2^k I_{Q3} - 0.7 + 0.7 + 1^k I_{Q4} \, \infty \not{5} = 0 \Rightarrow$ then $\boxed{I_{Q4} - 2 I_{Q3} = 0}$ $\xrightarrow{\text{**}}$
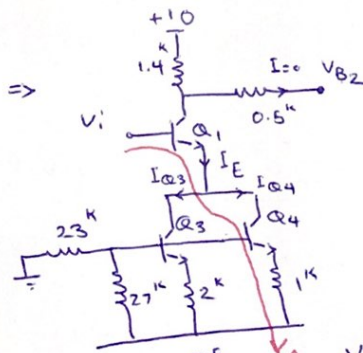
$I_E = \frac{1}{2} I_{Q4} + I_{Q4} = \frac{3}{2} I_{Q4} \Rightarrow \boxed{I_{Q4} = \frac{2}{3} I_E}$ (II)

(II) in (I) $\to$ $191.9\, I_E + 1^k(\frac{2}{3} I_E) = 8.8 \Rightarrow I_E = 0.04^{mA} = 40^{\mu A} \to \begin{cases} I_{Q4} = 26.6^{\mu A} \\ I_{Q3} = 13.4^{\mu A} \end{cases}$

$\Rightarrow V_E = 0.5 + 1^k(26.6^{\mu A}) = 0.526^v = 526^{mV} \Rightarrow \boxed{UTP = 0.526 + 0.7 = 1.226\,v}$

$V_0 = 10 - 1^k(0.04^{mA}) = \boxed{9.96}$

II) $\begin{cases} Q_1 : ON \\ Q_2 : off \end{cases} \Rightarrow$

$\begin{cases} V_{B2} = V_E + 0.7 \\ V_E = V_i - 0.7 + 0.5 \\ V_{B2} = V_i + 0.5 \end{cases}$

$\boxed{V_{B2} = 10 - 1.4^k I_{C1}}$ (I)
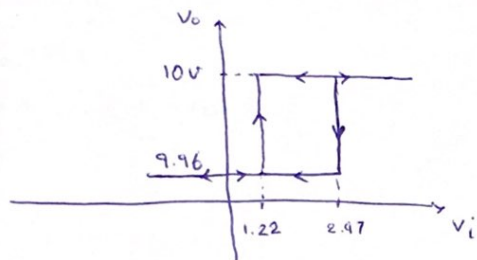
$I_E = I_{Q3} + I_{Q4} = \frac{\beta}{\beta+1} I_c$

KVL in A : $-V_i + 0.7 + 0.5 + 1^k I_{Q4} - 5 = 0$ $\xrightarrow{V_i = V_{B2} - 0.5}$ $-V_{B2} + 0.5 + 0.7 + 0.5 + 1^k I_{Q4} - 5 = 0$

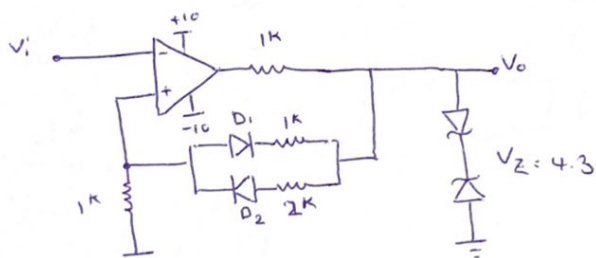$I_{Q4} = \frac{2}{3} I_E \to \boxed{V_{B2} = \cancel{\frac{13}{3} \frac{2}{3}} - 3.3 + \frac{2}{3} I_E} \Rightarrow \boxed{V_{B2} = -3.3 + \frac{200}{303} I_c}$ (II)

$$\begin{cases} V_{B2} + 1.4\, I_C = 10 \\ V_{B2} - 0.66\, I_C = -3.3 \end{cases} \Rightarrow \begin{cases} V_{B2} = 2.97^{\,v} \\ I_C = 5.01^{\,mA} \end{cases} \Rightarrow LTP = 2.97$$
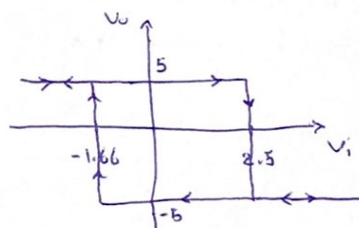

#3

$$V_o = \pm(V_Z + V_{D_{1,2}}) = \pm 5\,v$$

$$V_Z = 4.3$$

$$UTP = \frac{1^K}{1^K + 1^K}(4.3 + 0.7) = +2.5$$

$$LTP = \frac{-1^K}{1 + 2^K}(4.3 + 0.7) = -1.66$$

#4
$$\begin{cases} I_{0,max} = 20^{\,mA} \\ I_B^+ = I_B^- = 10\,\mu A \\ V_{CC} = V_{EE} = 15 \\ UTP = 3\,v \\ LTP = 2\,v \\ V_{OH} = 10 \\ V_{OL} = 5 \end{cases} \Rightarrow$$

 $\Rightarrow$
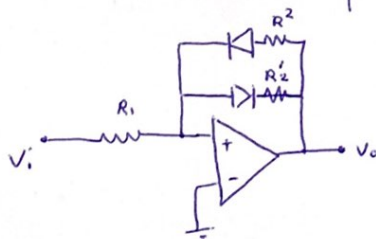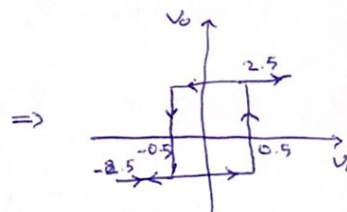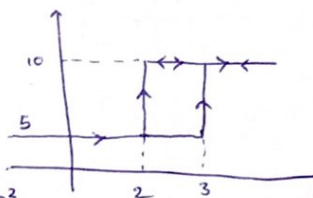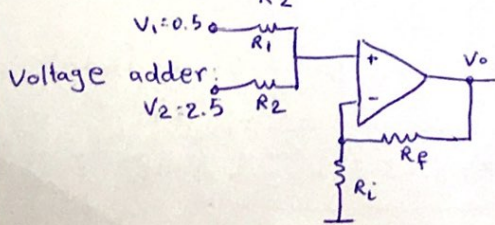

$$UTP = \frac{R_1}{R_2}(V_{OH} + 0.7)$$

$$LTP = \frac{-R_1}{R_2'}(V_{OL} + 0.7)$$

$$R_1 = 1^{k\Omega}$$

$$UTP:\quad 0.5 = \frac{1}{R_2}(2.5 + 0.7) \rightarrow R_2 = 6.4^K \longrightarrow \boxed{R_2 = 6.2^K} \Rightarrow UTP = 0.51\,v$$

$$LTP:\quad -0.5 = \frac{1}{R_2'}(-2.5 + 0.7) \rightarrow R_2' = 3.6^K \longrightarrow \boxed{R_2' = 3.6^k} \Rightarrow LTP = -0.5\,v$$

Voltage adder:

$V_1 = 0.5$ R_1

$V_2 = 2.5$ R_2

$$V_{in_1} = 0.5\left(R_2\right)/\left(R_1 + R_2\right)$$

$$V_{in_2} = \frac{0.5\,R_1}{R_1 + R_2}$$

$\longrightarrow V_{in_1} + V_{in_2} = V_{in}$

$$V_{out} = V_{in}\left(1 + \frac{R_f}{R_i}\right)$$