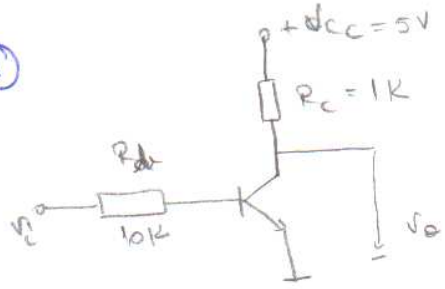
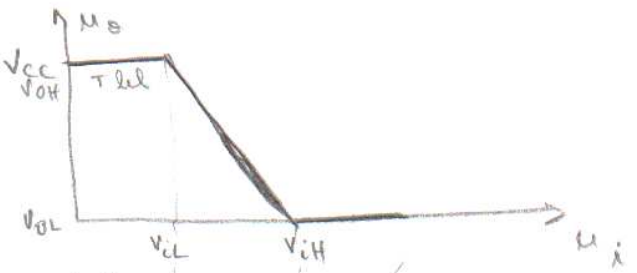
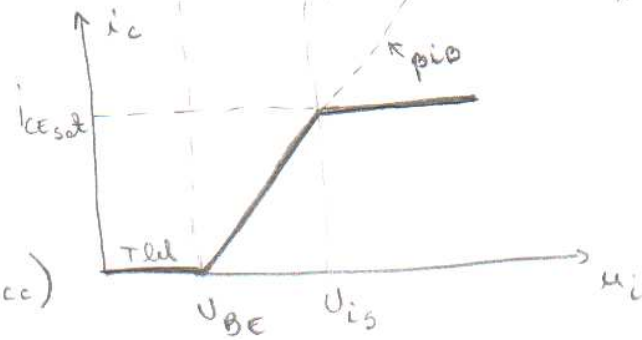
Pregătire examen

① 

$U_{BE} = 0,8V$, $\beta = 50$





$u_o = V_{cc} - i_c R_c$ (1)

$u_i < U_{BE} \Rightarrow$ T blocat

$(i_B = i_C = 0 ; V_o = V_{cc})$

$u_i > U_{BE} \Rightarrow$ T deschis

$$i_B = \frac{u_i - U_{BE}}{R_b}$$

în RAN ($u_{CE} > 0$ pt. $u_o > 0$)

$$i_C = \beta i_B \Rightarrow u_o = V_{cc} - \beta \frac{R_c}{R_b} \cdot (u_i - U_{BE})$$

(înlocuit în rel. (1))

T este în RAN pt. $U_{BE} < u_i < U_{is}$

Pt $u_i > U_{is}$, T este saturat, $u_o = 0$, $i_C = \frac{V_{cc}}{R_c} = i_{Csat}$

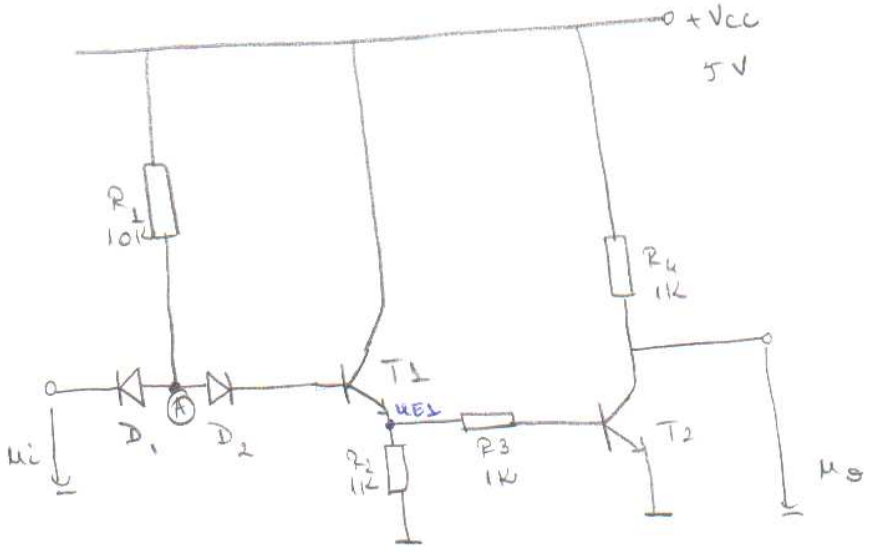
Pt $u_i = U_{is}$, T este la saturație incipientă

$$i_B = \frac{i_C}{\beta} = \frac{i_{Cs}}{\beta} = \frac{V_{cc}}{\beta R_c} = i_{Bsi}$$

$u_o = 0$ (2) $i_B = i_{Bsi} \Rightarrow u_{is} = U_{BE} + \frac{V_{cc} R_b}{\beta R_c}$

$$\begin{cases} i_B > i_{Bsi} \Rightarrow T \text{ în SAT} \Rightarrow i_C = i_{Cs} \\ i_B < i_{Bsi} \Rightarrow T \text{ în RAN} \Rightarrow i_C = \beta i_B \\ i_B = i_{Bsi} \Rightarrow U_{is} \end{cases}$$

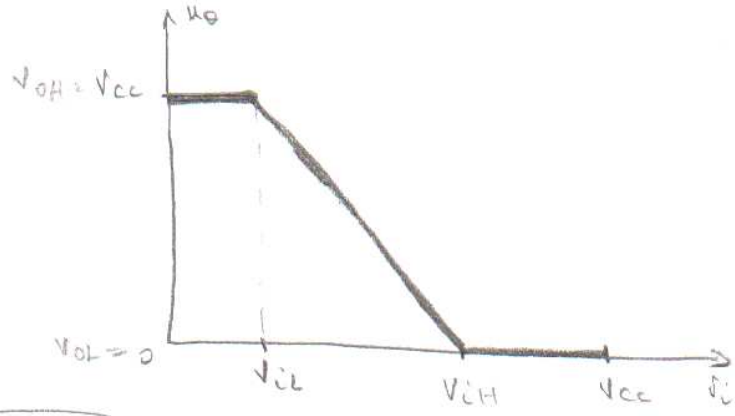
(2)



$u_{BE} = 0,8V$

$u_{BE_0} = 0,6V$

$\beta = 50$



- pt $\boxed{u_i = 0}$ avem:

  D_1 deschisă $\Rightarrow u_A = U_\gamma$ $\Rightarrow$

  $\Rightarrow D_2$, T_1, T_2 blocate $\Rightarrow \boxed{u_0 = V_{cc} = V_{OH}}$

- pt $\boxed{u_i < V_{iL}}$ avem:

  T_2 blocat $\Rightarrow u_0 = V_{cc}$

- pt $\boxed{u_i = V_{iL}}$ avem:

  T_2 se deschide $\Leftrightarrow u_{B_2} = U_{BE_0}$

$V_{iL} = \underbrace{U_{BE_0}}_{T_2} + \underbrace{u_{BE}}_{T_1} + \underbrace{U_\gamma}_{D_2} - \underbrace{U_\gamma}_{D_1} = 1,4V$

- pt $\boxed{u_i = V_{cc}}$:

  D_1 blocată, T_1, T_2 deschise

  T_1 în RAN (pt că $u_{C_1} = V_{cc} > u_{E_1}$)

$u_A = u_{E_1} + U_{BE} + U_\gamma$

$i_{B_1} = \dfrac{V_{cc} - U_{BE} - U_\gamma - u_{E_1}}{R_3}$ (1)

$$i_{E_1} = \frac{u_{E1}}{R_2} + \frac{u_{E1} - U_{BE}}{R_3} \quad (2)$$

$$i_{E_1} = \beta\, i_{B1} \quad (3)$$

(1), (2), (3) $\Rightarrow u_{E1} = \dots$

$$i_{B_2} = \frac{u_{E1} - U_{BE}}{R_3}$$

$i_{B_2} > i_{B_2 sl} = \frac{V_{CC}}{\beta R_4} = 0{,}1\,mA \Rightarrow T_2$ saturat $\Rightarrow$ **$u_0 = 0 = V_{OL}$**

- pt $u_i > V_{iH}$ avem

  T_2 saturat $\Rightarrow u_0 = 0$

- pt $u_i = V_{iH}$ avem

  T_2 la saturație incipientă

  $i_B(V_{iH}) = i_{B_2 sl}$

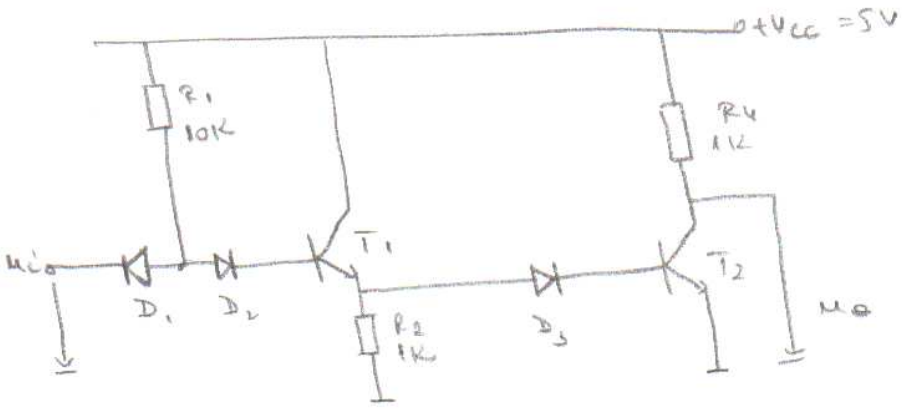
  D_1 deschisă

$$i_{B_2} = \frac{u_i + \overbrace{U_D}^{D_1} - \overbrace{U_D}^{D_2} - \overbrace{U_{BE}}^{T_1} - \overbrace{U_{BE}}^{T_2}}{R_3}$$

$$i_{B_2 sl} = \frac{V_{CC}}{\beta R_4}$$

$\Rightarrow$ **$V_{iH} = 2V_{BE} + \frac{V_{CC}}{\beta} \cdot \frac{R_3}{R_4}$**

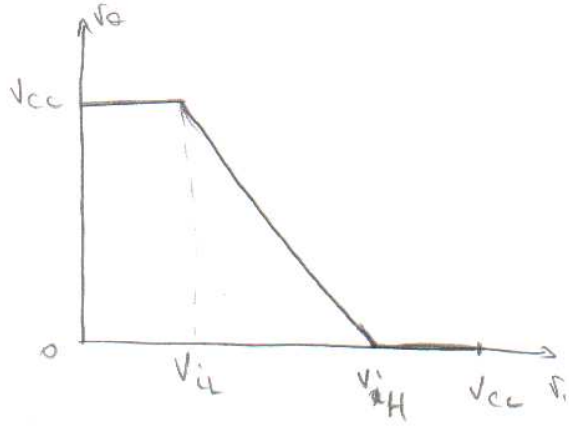
(3)



$U_{BE} = 0,8V$

$U_{BE_0} = 0,6V$

$\beta = 50$



• $u_i = 0$ avem:

D_1 deschisă $\Rightarrow u_A = u_3$

D_2, T_1, D_3, T_2 blocat $\Rightarrow$ $u_0 = V_{cc} = V_{OH}$

• $u_i < V_{il}$ avem: T_2 blocat.

• $u_i = V_{il}$ avem:

T_2 de deschide (simulăm cu dioda D_3)

$$V_{il} = \underbrace{V_{BE_0}}_{T_2} + \underbrace{U_{D0}}_{D_3} + \underbrace{V_{BE}}_{T_1 d} + \underbrace{U_D}_{D_2 d} - \underbrace{U_D}_{D_1 d} = 2V$$

• $u_i = V_{cc}$ avem:

D_1 blo, D_2, D_3, T_1, T_2 deschise

T_1 în RAN ($u_{CB} > u_{E3}$)

$$i_{B_1} = \frac{V_{cc} - 2U_{BE} - 2U_D}{R_1} = 0,18\,mA.$$

$$i_{B_2} = i_{E_1} - i_{R_2} = \beta i_{B_1} - \frac{u_{D3} + U_{BE_2}}{R_2} = 4,4\,mA$$

$$i_{B_2} > i_{B_2 si} = \frac{V_{cc}}{\beta R_4} \Rightarrow T_2 \text{ sat} \Rightarrow u_0 = 0 = V_{OL}$$

- $u_i > V_{iH}$ avem:

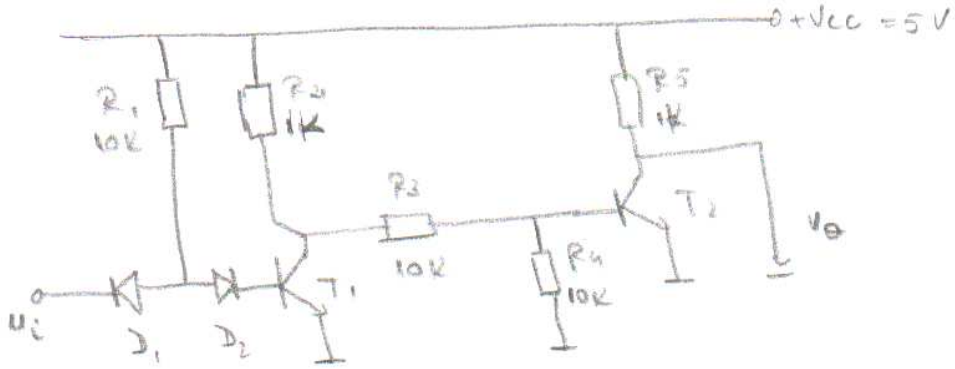
  T_2 saturat, D_1 blocată.

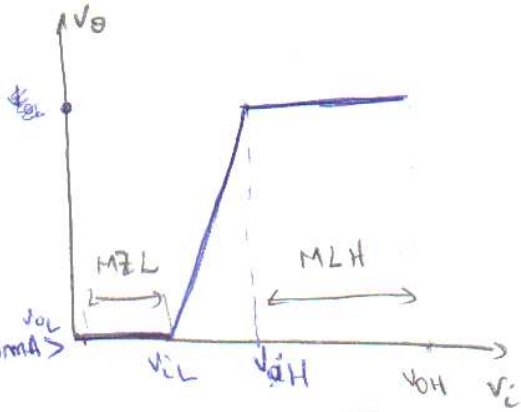
- $u_i \geq V_{iH}$ avem:

  D_1 se deschide / blochează

$$V_{iH} = \underbrace{2V_{BE}}_{T_{1,2}} + \underbrace{2U_D}_{D_{2,3}} - \underbrace{U_{D0}}_{D_1} = 2,6\,V$$

③





- $u_i = 0$ avem:

  D_1 deschisă $\Rightarrow D_2$ blocată, T_1 blocat

  T_2 deschis.

$$i_{B_2} = i_{R_3} - i_{R_4} = \frac{V_{CC} - V_{BE}}{R_2 + R_3} - \frac{V_{BE}}{R_4} = 0,3\,mA > i_{B_{2,sat}} \geq \frac{V_{CC}}{\beta R_5} = 0,1\,mA \Rightarrow T_2 \text{ este saturat} \Rightarrow u_0 = 0 = V_{0L}$$

- $u_i < V_{iL}$ avem:

  T_2 saturat, T_1 blocat

- $u_i \geq V_{iL}$ avem T_2 la saturație incipientă $\Leftrightarrow i_{B_2} \triangleq i_{B_{2si}}$

  D_1, D_2 deschise, T_1 în RAN.

  nu putem calcula $i_{B_2}(u_i)$

- $u_i \geq V_{iE}$; T_1 se deschide

$$V_{iE} = \underbrace{U_{BE_0}}_{T_1} + \underbrace{U_{D_0}}_{D_2} - \underbrace{U_D}_{D_1} = 0,4\,V$$

- $u_i = V_{cg}$: D_1 blocat ; T_1 deschis

$$i_{B_1} = \frac{V_{cc} - U_D - U_{BE}}{R_1} = \ldots > i_{B_{S1}} = \frac{V_{cc}}{\beta R_2} \Rightarrow T_1 \text{ saturat}$$

$u_{C_1} = 0 \Rightarrow T_2$ blocat $\quad u_0 = V_{cc} = V_{OH}$

- $u_i > V_{iH}$: T_2 blocat, T_1 saturat, D_1 blocată

- $u_i = V_{iH}$: D_1 se deschide (blocheză).

$$V_{iH} = U_{BE} + U_D - U_{D_0} \approx 1V$$

$$MZH = V_{OH} - V_{iH}$$

$$MZL = V_{iL} - V_{OL}$$

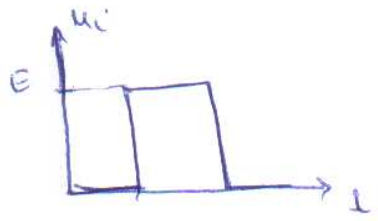
$$n = \frac{i_B}{i_{B_{S1}}} - 1$$ (în starea în care era tranzistorul saturat)

$$P_{d_{med}} = V_{cc} \cdot \frac{I_{CCH} + I_{CCL}}{2}$$

, i punem intrare consumatoare, adică V_{cc}.

$$I_{CCH} = \underbrace{\frac{V_{cc} - U_D - V_{BE}}{R_1}}_{i_{R_1}} + \underbrace{\frac{V_{cc}}{R_2}}_{i_{C_1 sat}}$$

$$I_{CCL} = \underbrace{\frac{V_{cc} - U_D}{R_1}}_{i_{R_1}} + \underbrace{\frac{V_{cc} - V_{BE}}{R_2 + R_3}}_{i_{R_2}} + \underbrace{\frac{V_{cc}}{R_5}}_{i_{C_2 sat}}$$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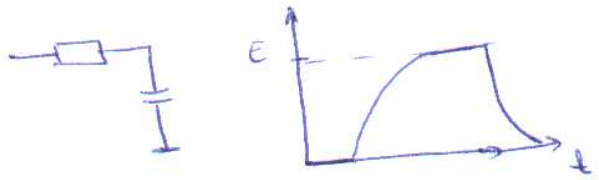
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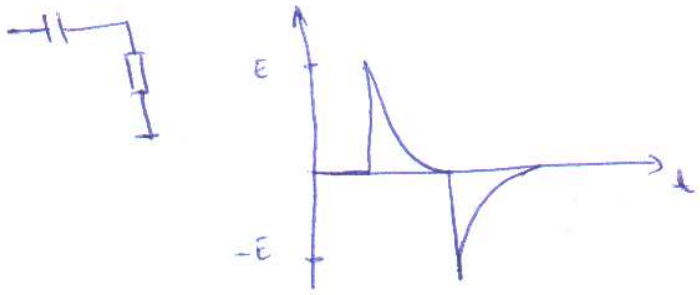
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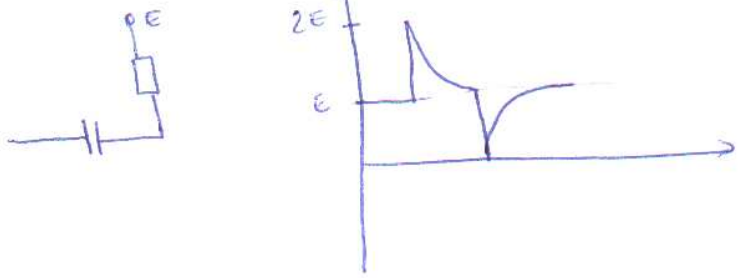
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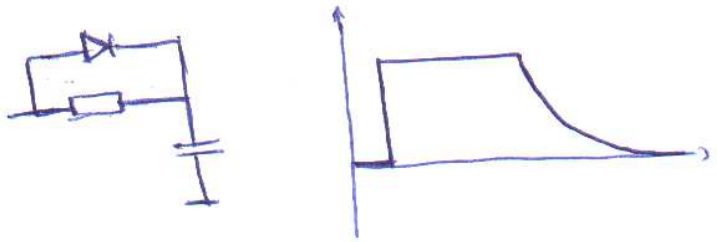
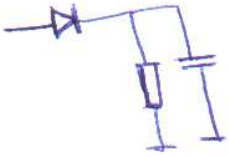
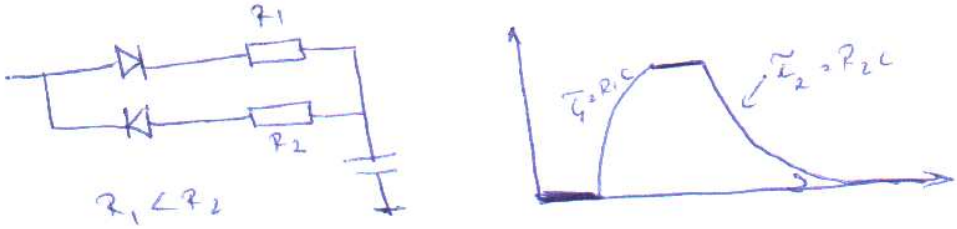
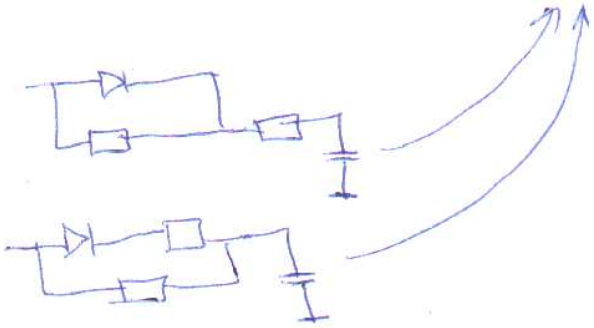
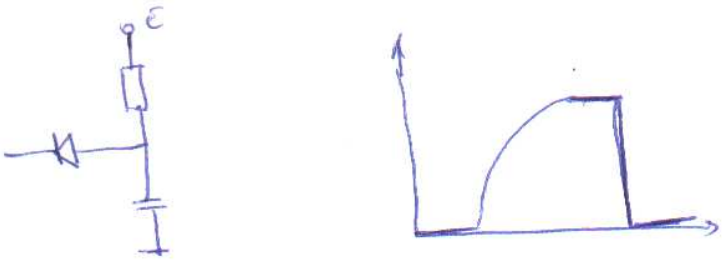





R_1
R_2
$R_1 < R_2$
$\tau_1 = R_1 C$
$\tau_2 = R_2 C$





0 0	0 → 1
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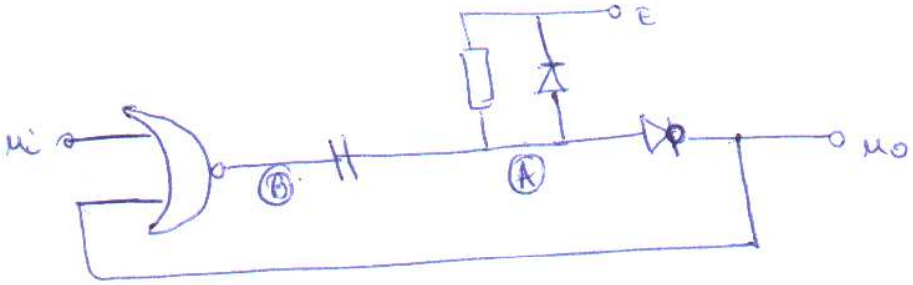

inițial, tăiem condensatorul, ca în A vom avea E