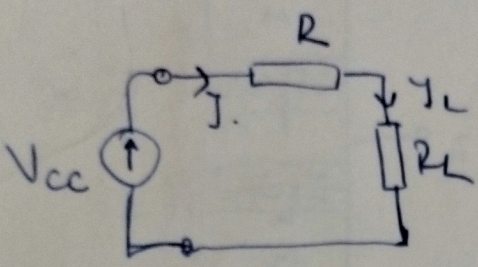
SEMINAR 3 ELECTRONICĂ II

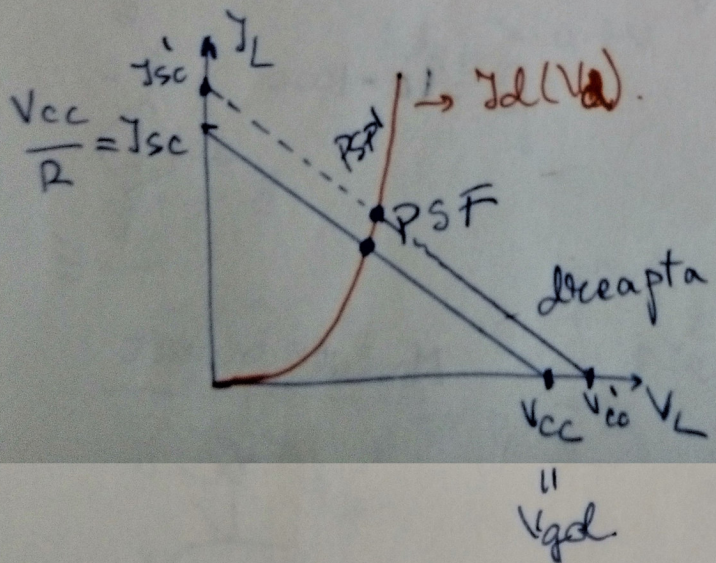
Dreapta de sarcină:



$$V_{CC} = I \cdot R + V_L$$

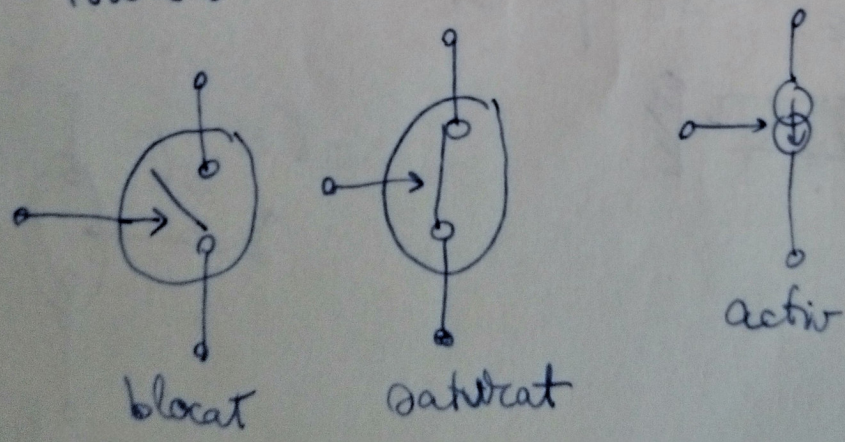
$$\boxed{V_L = V_{CC} - I_L \cdot R}$$

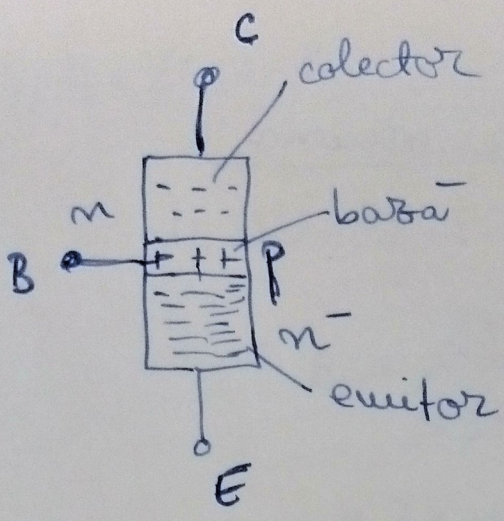
$$-I_L = \frac{V_L - V_{CC}}{R} \Rightarrow \boxed{I_L = \frac{V_{CC} - V_L}{R}} = I_{SC} - \frac{1}{R} \cdot V_L$$

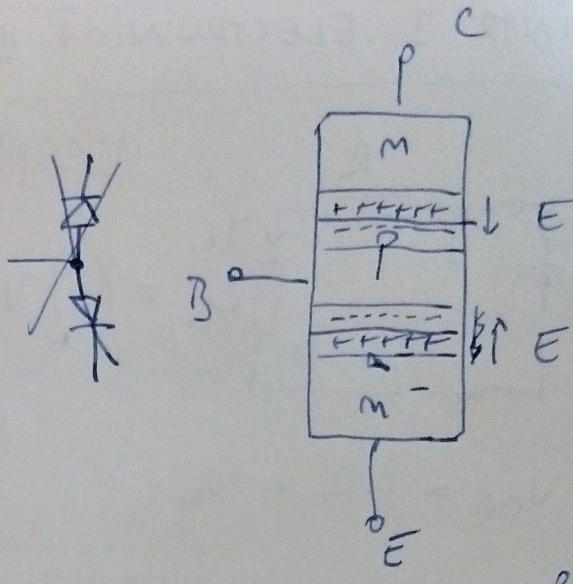


Tranzistorul bipolar:

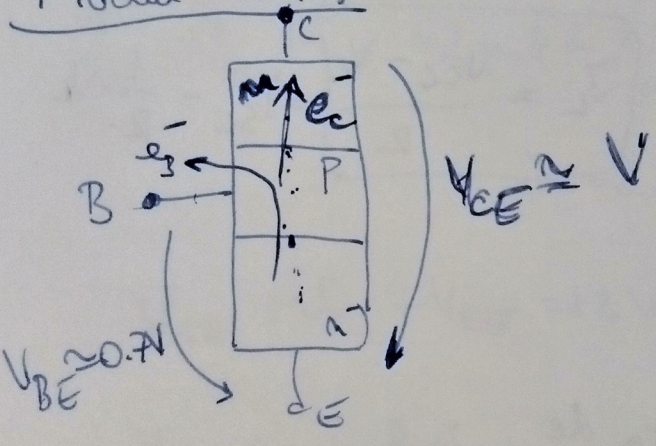
- switch controlabil electronic (blocat/saturat)
- sursă de curent (activă)







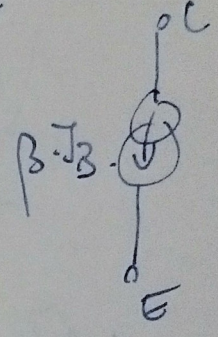
Modul activ:



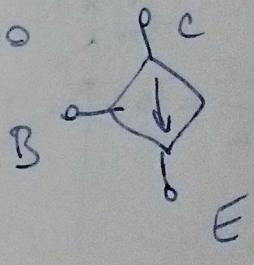
$V_{CE} \simeq V$

$V_{BE} \simeq 0.7V$

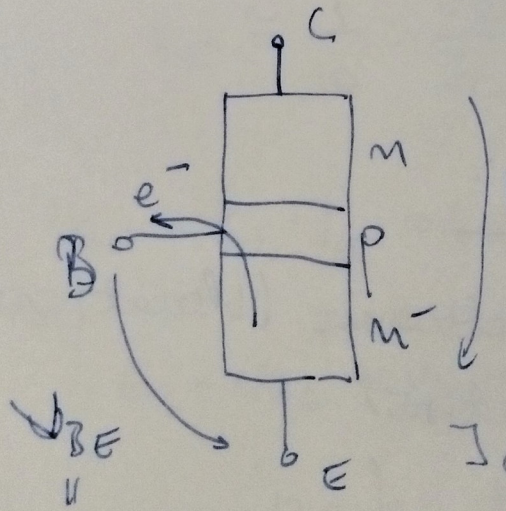
$I_C = \beta \cdot I_B$.



$\beta = 10 - 1000$



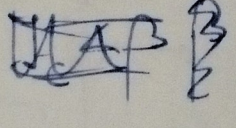
Modul saturat:

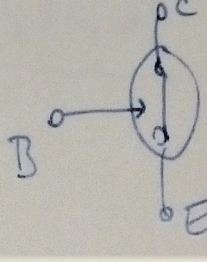


$V_{CE} \simeq 0.2V$.

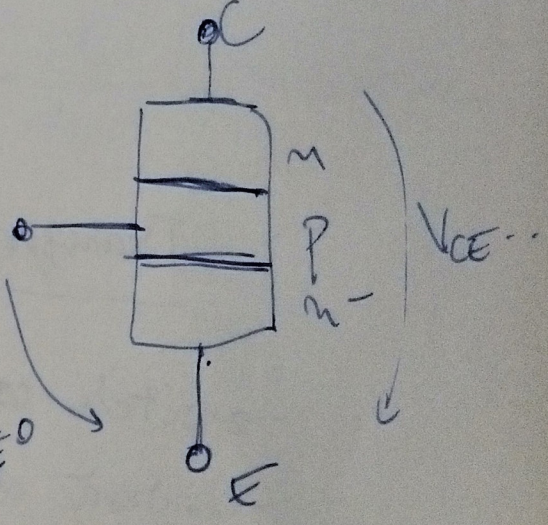
$V_{BE} \parallel 0.7V$

$I_C < \beta \cdot I_B$.



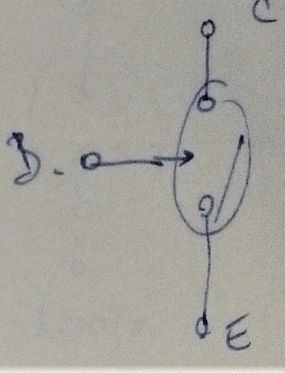


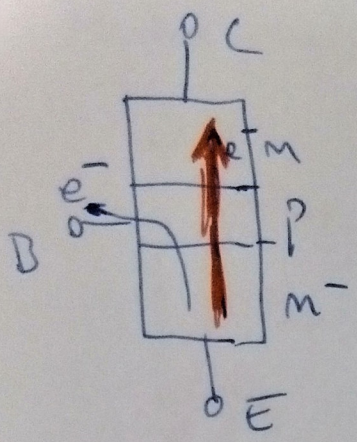
Modul blocat



$V_{CE} \dots$

$V_{BE} = 0$

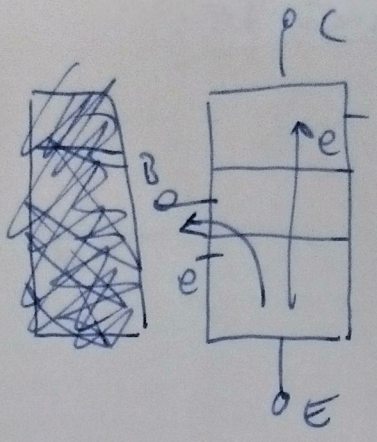




activ.

$V_{CE} > 0$

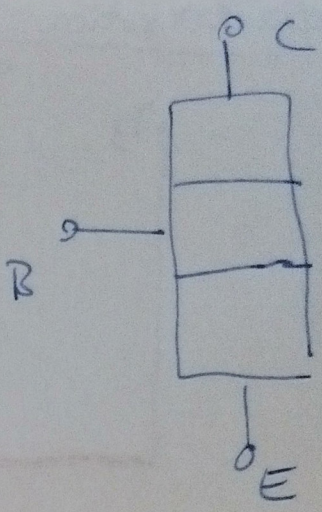
$I_C \simeq \beta \cdot I_B$



Saturație

$V_{CE} \simeq 0 - 0.2V$

$I_C < \beta \cdot I_B$



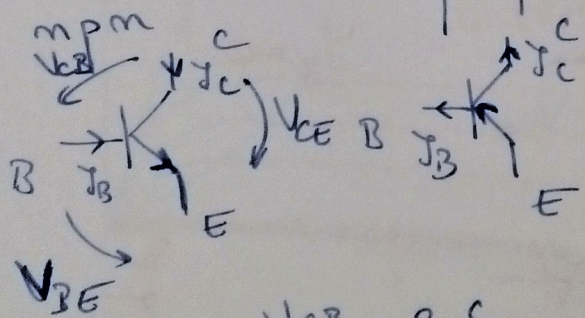
$V_{CE} \geq 0.$

$I_C = 0.$

$V_{BE} \simeq 0.7V$

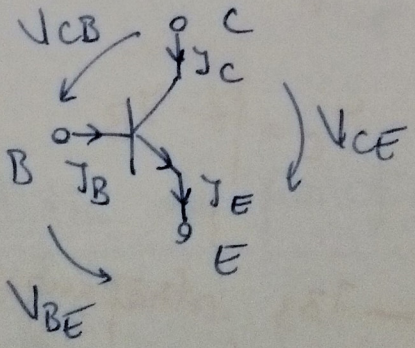
$V_{BE} < 0.7V.$

BJT:



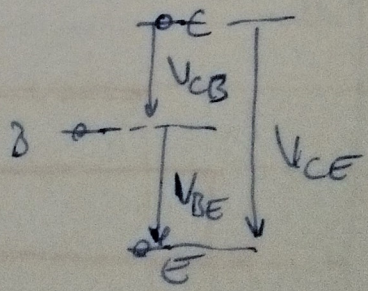
$I_C \sim \mu A.$

$I_B \sim \mu A.$



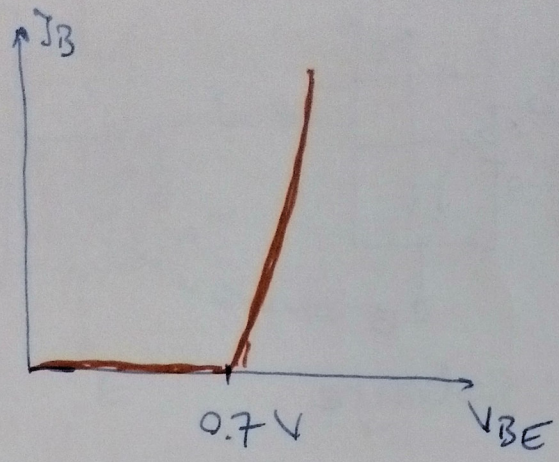
$I_E = I_C + I_B$

$V_{CB} = V_{CE} - V_{BE}$

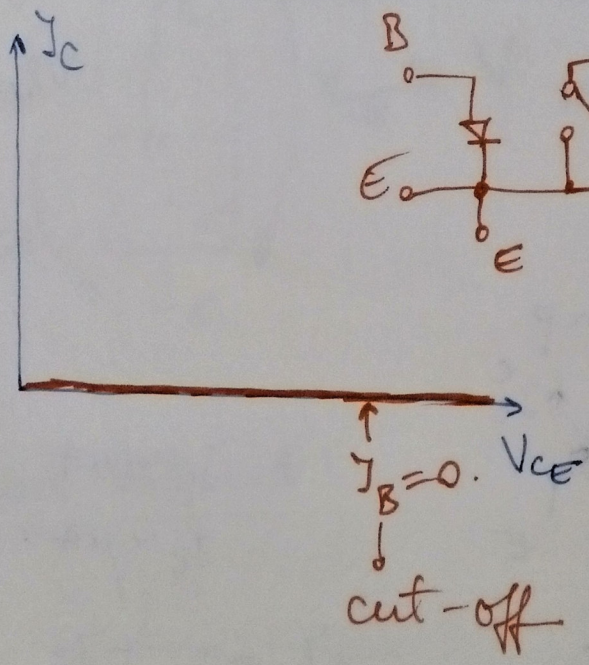


$I_E \simeq I_C$

Caracteristica joncțiunii BE:

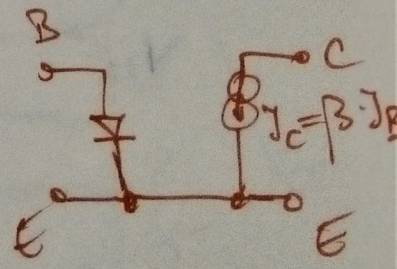


Caracteristicile electrodului:

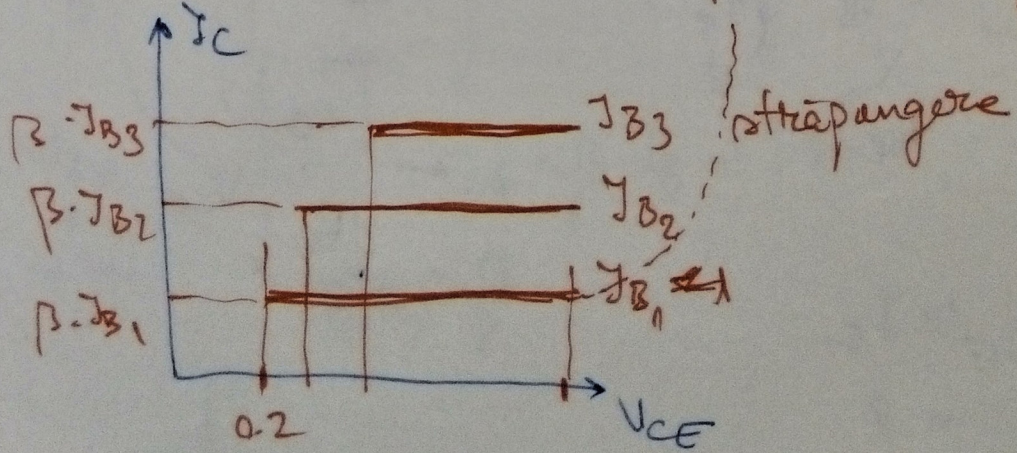


mod blocat

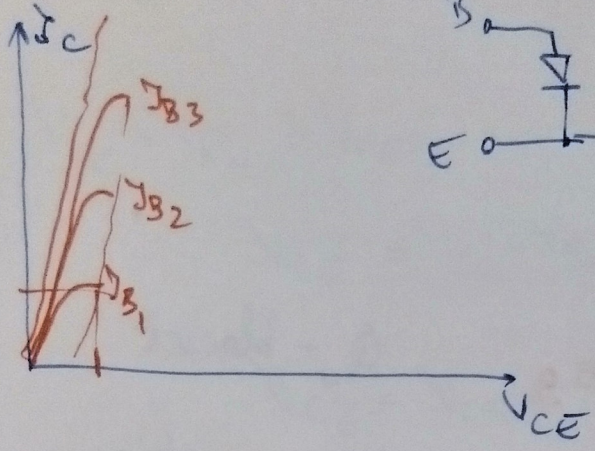
$I_B = 0$.

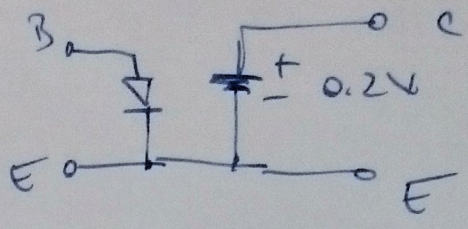


mod activ. $I_C = \beta \cdot I_B$



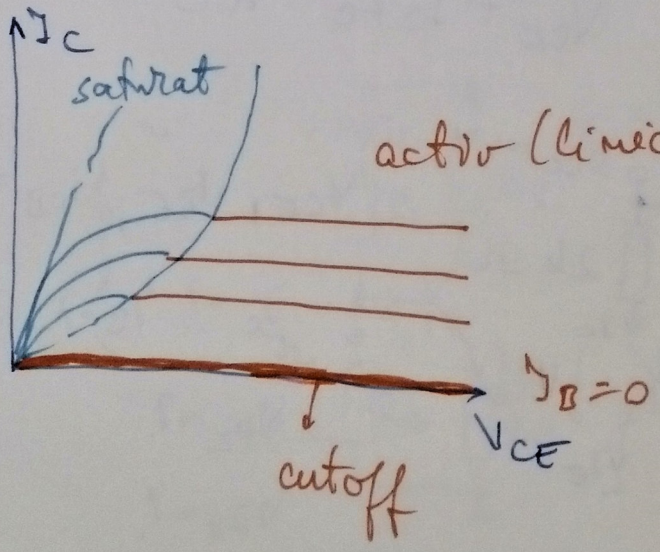
Modul saturat



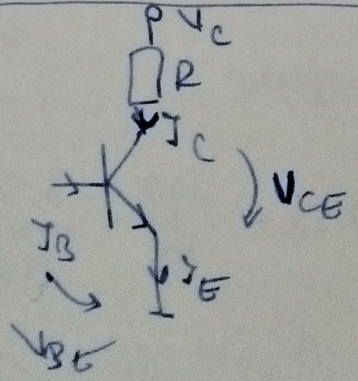


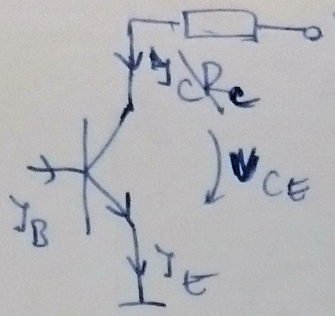
$$P_T = V_{CE} \cdot I_C + V_{BE} \cdot I_B .$$

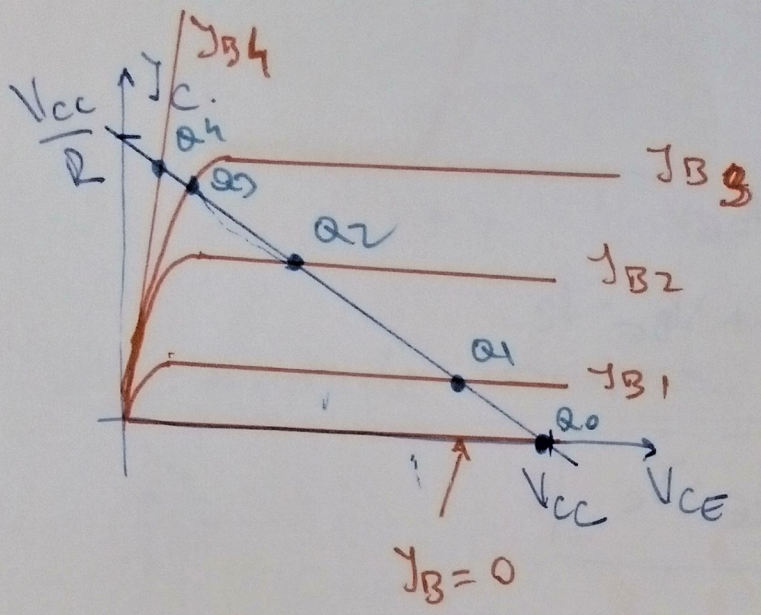
$$\boxed{P_T \simeq V_{CE} \cdot I_C}$$



Punctul static de funcționare al TB.







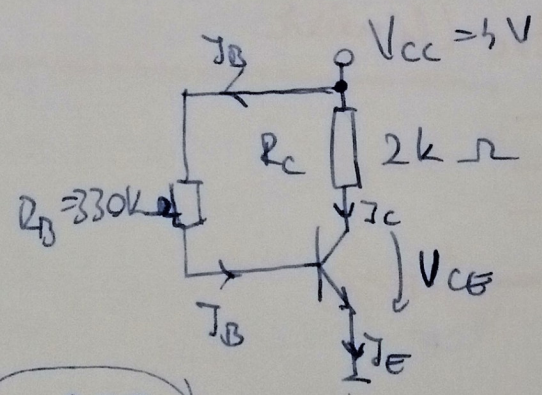
Q_0 - blocat

Q_1, Q_2 - activ.

Q_3, Q_4 - saturat

$$V_{CE} + I_C R_C = V_{CC}$$

(1)



$\beta = 400$

$V_{CE}, V_{BE}, V_{CB} = ?$

$I_C = ?$ $I_B = ?$ $I_E = ?$

$V_{R_C} = ?$

$V_{R_B} = ?$

$V_{BE} \simeq 0.7V.$

$I_C = \beta \cdot I_B =$

$= 400 \cdot 10\,\mu A =$

$= 4\,mA$

$V_{RB} = V_{CC} - V_{BE} = 4 - 0.7 = 3.3V.$

$$V_{RB} = I_B \cdot R_B \Rightarrow I_B = \frac{V_{RB}}{R_B} = \frac{3.3V}{330 \cdot 10^3\,\Omega} =$$

$$= \frac{3.3}{330}\,mA = 0.01\,mA = 10\,\mu A.$$

$V_{R_C} = I_C \cdot R_C = 2\,\mu A \cdot 2000\,\Omega = 2000\,mA \cdot \Omega = 2V$

$V_{CC} = V_{R_C} + V_{CE}$

$V_{CE} = V_{CC} - V_{R_C} = 4 - 2 = 2V.$

$V_{CB} = V_{CE} - V_{BE} = 2 - 0.7 = 1.3V.$

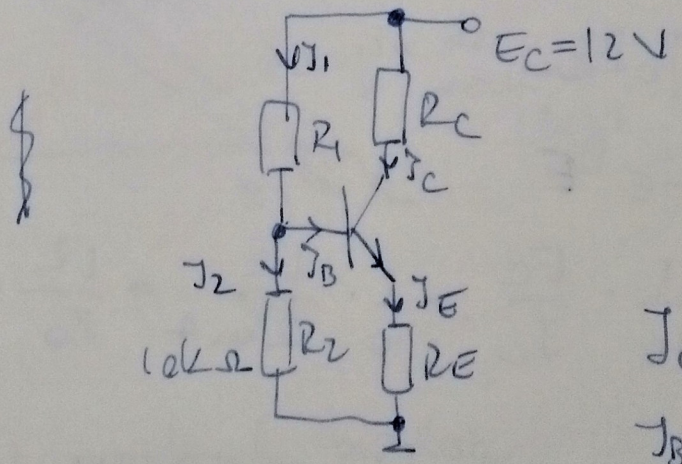
p10.

$\beta = 100.$

~~R_1~~ R_C R_E $I_C = 2\,\mu A$

~~$I_B = ?$~~ $V_{CE} = 3V$

$U_{BE} = 0.65V.$



$I_C = \beta \cdot I_B$

$I_B = \frac{I_C}{\beta} = \frac{2\mu A}{100} = 20\,\mu A.$

$U_{R_2} = U_{BE} = 0.65$

$12 = U_{R_1} - 0.65 \quad U_{R_1} = 11.35V.$

$I_1 = I_2 + I_B \qquad I_1 = 65 + 20\,\mu A = 85\,\mu A$

$U_{R_2} = I_2 R_2 \Rightarrow 0.65 = I_2 \cdot 10k\Omega$

$I_2 = \frac{0.65}{10.000} = 65\,\mu A$

$U_{R_1} = I_1 \cdot R_1 = 85\mu A \cdot R_1$

$11.35V = 85\mu A \cdot R_1$

~~$R_1 = \frac{85}{11.35} \cdot 10^6 = 7.48\,M\Omega$~~

$R_1 = \frac{11.35}{85} \cdot 10^6 \Omega = 0.133 \cdot 10^6 \Omega = 133 k\Omega$

$I_E = I_C + I_B = 2mA + 65\mu A = 2 + 0.065\,mA = 2.065\,mA$

$I_C = 2mA$

$U_{CE} + U_{R_C} + U_{R_E} = 12V$

$U_{R_C} = I_C R_C$

$U_{R_E} = I_E R_E$

$R_E \cong \frac{1}{10} \cdot \frac{E_C}{I_C} = \frac{1}{10} \cdot \frac{12}{2mA} = \frac{12}{20} \cdot 10^3 = 600\,\Omega$

$U_{R_E} = R_E \cdot I_E = 600 \cdot 2.065 = 1.239V$

$E_C = U_{R_C} + U_{CE} + U_{R_E}$

$12 = U_{R_C} + 3 + 1.239 = 7.761V = I_C R_C =$

$= 2mA \cdot R_C$

$R_C = \frac{7.761}{2} \cdot 10^3 = 3.88 k\Omega$

TEMĂ: 11, 12, 13.