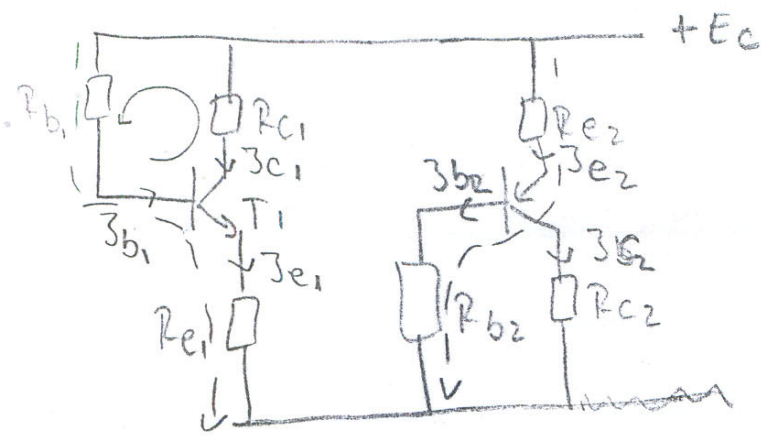


① PSF:



$$\beta_{b1} = \frac{\beta_{c1}}{100}$$

$$\beta_{e1} \approx \beta_{c1}$$

$$\beta_{b1} R_{b1}$$

$$E_c = \frac{\beta_{c1}}{100} R_{b1} + U_{BE} + \beta_{c1} R_{e1} \Rightarrow \beta_{c1}(9,4 + 2) = 12 - 0,6 \Rightarrow$$

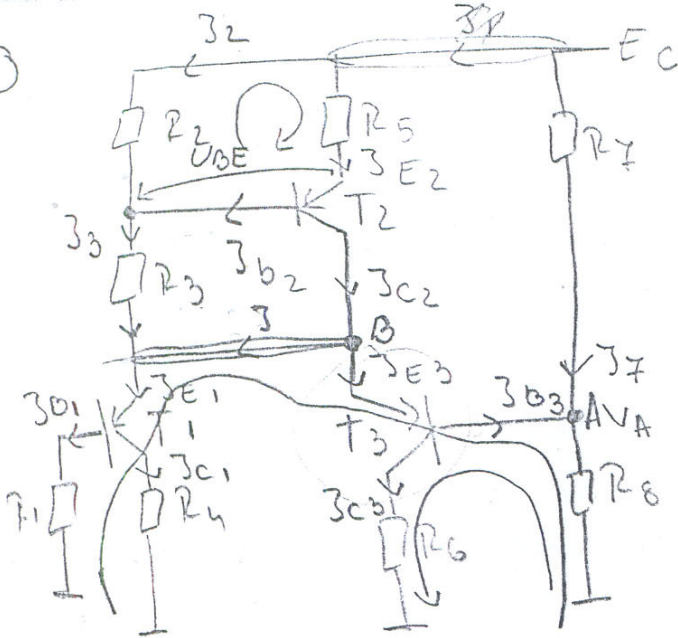
$$\beta_{c1} = \frac{11,4}{11,4 \cdot 10^3} = \boxed{100 \mu A = \beta_{c1}}$$

$$E_c = \beta_{c2} R_{e2} + U_{EB} + \frac{\beta_{c2}}{100} R_{b2} \Rightarrow \beta_{c2}(1 + 9,4) = 12,5 - 0,6 \Rightarrow \beta_{c2} = \frac{11,4}{10,4}$$

$$E_c = \beta_{c1} R_{c1} + U_{CE1} + \beta_{c1} R_{e1} \Rightarrow \boxed{U_{CE1} = 12 - 0,8 = 4}$$

$$E_c = \beta_{c2} (R_{e2} + R_{c2}) + U_{EE} \Rightarrow U_{CE} = \frac{\frac{5,7}{10,4}}{5,2} \cdot 4 - 12 = \frac{5,7}{13} - 12 = \frac{99}{13} \approx 7,6$$

②

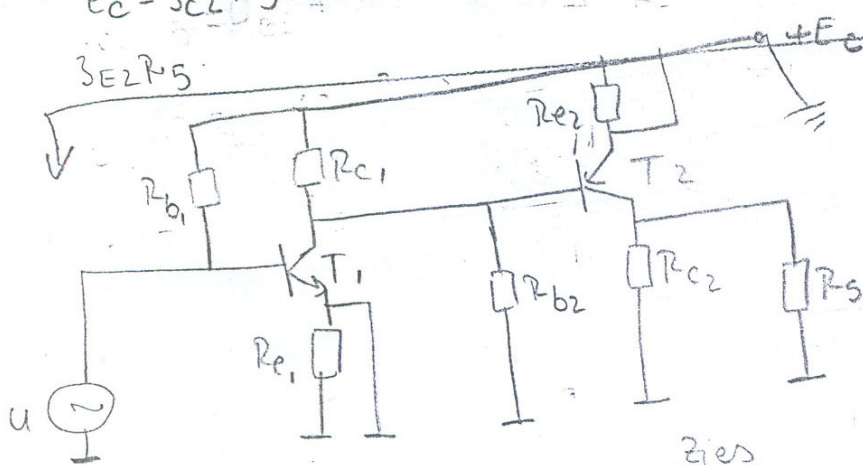


$$E_c = I_{T7} (R_{T7} + R_8) \Rightarrow I_{T7} = \frac{20}{10} = 2 \text{ mA}$$

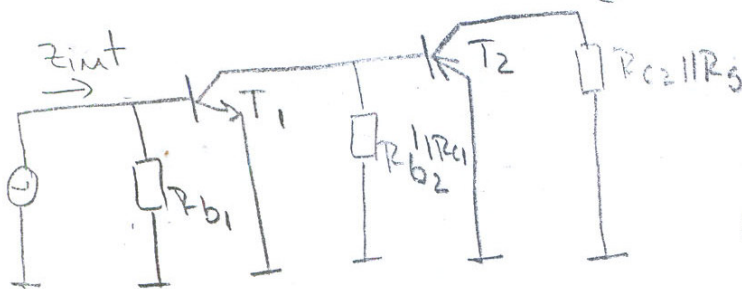
$$V_A = \frac{R_8}{R_{T7} + R_8} \cdot E_c = \frac{47}{10} \cdot 20 = 9,4 \text{ V}; \quad V_B = V_A - U_{BE} = 8,8 \text{ V}$$

$$-\frac{\beta_{C1}}{100} R_1 + U_{BE} - U_{BE} + I_{T7} R_8 = 0 \Rightarrow \frac{\beta_{C1}}{100} \cdot 9,4 = 2 \cdot 4,7 \Rightarrow \boxed{\beta_{C1} = 1 \text{ mA}}$$

$$E_c = \beta_{C2} R_5 - U_{BE} + I_{T2} R_3 + U_{BE} + I_{B1} R_1$$



① continue



$$A_p = A_u \cdot h_{21T1} \cdot h_{21T2}$$

$$Z_{int} = R_{b1} \parallel h_{11T1}$$

$$Z_{ies} = R_{c2} \parallel R_D$$

$$A_u = -\frac{h_{21T1}}{h_{11T1}} \left(R_{c1} \parallel R_{b2} \parallel h_{11T2} \right) \left(-\frac{h_{21T2}}{h_{11T2}} \cdot R_{c2} \parallel R_S \right)$$

$$-\frac{I_{c1}}{100} R_1 - U_{BE} + U_{BE} + I_7 R_8 = 0 \Rightarrow I_{c1} = 9,4 \cdot \frac{100}{940} = \boxed{1 \text{ mA} = I_{c1}} \quad (\text{Q})$$

$$I_2 R_2 = I_{c2} R_5 + U_{BE} \Rightarrow I_2 = \frac{1}{R_2} (I_{c2} R_5 + U_{BE}) = 1$$

$$E_c = I_{c2} R_5 + U_{BE} + I_2 R_3 + U_{BE} + I_{b1} R_4 \Rightarrow 20 = 2,5 I_{c2} + 1,2 + 9,4 +$$

$$+ \frac{4,4}{5,6} (I_{c2} \cdot 2,5 + 0,6) \Rightarrow 9,4 \cdot 14 = 2,5 \cdot 25 I_{c2} + 6,6 \Rightarrow \boxed{I_{c2} = 2 \text{ mA}}$$

$$I_3 = I_2 = 1 + I_{c3} \Rightarrow \boxed{I_{c3} = 2 \text{ mA}}$$

$$E_c = I_2 (R_2 + R_3) + U_{CE1} + I_{c1} R_4 \Rightarrow U_{CE1} = 20 - 10 - 5 \Rightarrow \boxed{U_{CE1} = 5 \text{ V}}$$

$$E_c = I_{c2} R_5 + U_{CE2} + U_{CE1} + I_{c1} R_4 \Rightarrow U_{CE2} = 20 - 5 - 5 - 5 \Rightarrow \boxed{U_{CE2} = 5 \text{ V}}$$

$$E_c = I_{c2} R_5 + U_{CE2} + U_{CE3} + I_{c3} R_6 \Rightarrow U_{CE3} = 20 - 5 - 5 - 6 \Rightarrow \boxed{U_{CE3} = 4 \text{ V}}$$