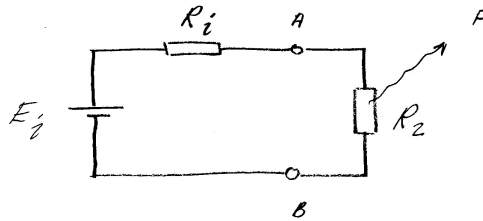


Lösningsförslag till tentamen 2019-08-26 TMMI04 Elektroteknik

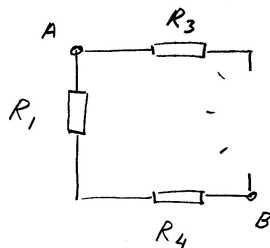
1.



a) $P = P_{MAX}$ OM $R_2 = R_i$

NOLLSTÄLL " E OCH J_0 .

BERÄKNA R_i MELLAN A OCH B

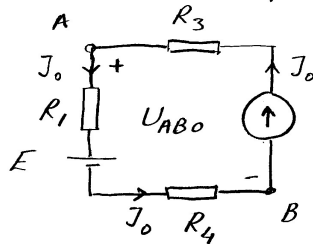


$$R_i = R_1 + R_4$$

$$\Rightarrow R_i = 4,0 \Omega$$

ALLTSÅ, VÄLT $R_2 = 4,0 \Omega$ FÖR $P = P_{MAX}$

b) $P_{MAX} = \frac{E_i^2}{4R_i}$ DÄR $E_i = U_{ABO}$



NOLLSTÄLL " E $\Rightarrow U_{ABO}' = R_1 \cdot J_0 + R_4 \cdot J_0$

$$\Rightarrow U_{ABO}' = 8,0 \text{ V}$$

NOLLSTÄLL " $J_0 \rightarrow U_{ABO}'' = E \Rightarrow$

$$U_{ABO}'' = 12 \text{ V}$$

$$U_{ABO} = U_{ABO}' + U_{ABO}'' \Rightarrow E_i = 20 \text{ V}$$

$$P_{MAX} = \frac{20^2}{4 \cdot 4,0} = \underline{\underline{25 \text{ W}}}$$

2a)

$$J = \frac{U}{\sqrt{R^2 + (\omega L)^2}} \Rightarrow$$

$$J = \frac{230}{\sqrt{24,0^2 + (2\pi \cdot 50,0 \cdot 57,3 \cdot 10^{-3})^2}} \approx$$

$$\approx \underline{\underline{7,67 \text{ A}}}$$

$$b) \quad P = R \cdot J^2 \Rightarrow \underline{\underline{P \approx 1,41 \text{ kW}}}$$

(Q_L)

$$Q = \omega L \cdot J^2 \Rightarrow \underline{\underline{Q \approx 1,06 \text{ kVAR}}}$$

$$S = \sqrt{P^2 + Q^2} \Rightarrow \underline{\underline{S \approx 1,76 \text{ kVA}}}$$

$$c) \quad Q = 0 \text{ om } Q_C = Q_L$$

$$Q_C = \frac{U^2}{1/\omega C} = 2\pi f C U^2 \Rightarrow$$

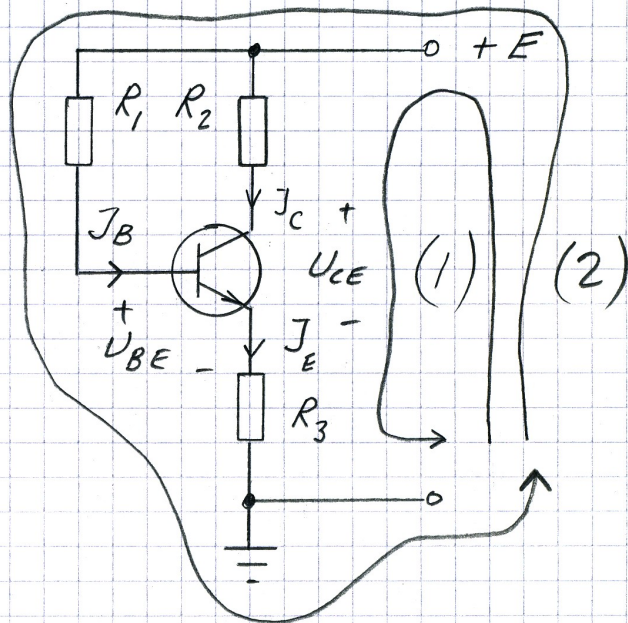
$$1,06 \cdot 10^3 = 2\pi \cdot 50 \cdot C \cdot 230^2 \Rightarrow$$

$$\underline{\underline{C = 63,7 \mu\text{F}}}$$

$$d) \quad Q = 0 \Rightarrow S = P$$

$$S = U \cdot J \Rightarrow 1,41 \cdot 10^3 = 230 \cdot J \Rightarrow \underline{\underline{J = 6,13 \text{ A}}}$$

4a) LKSTROMSSCHEMA



$$h_{FE} = \frac{J_C}{J_B} \Rightarrow J_B = \frac{0,0040}{200} = 20 \mu A$$

$$J_E = J_B + J_C \Rightarrow J_E = 4,020 \text{ mA}$$

$$+E - R_2 J_C - U_{CE} - R_3 J_E = 0 \dots (1)$$

$$\Rightarrow 12 - 1000 \cdot 0,0040 - 4,0 - R_3 \cdot 0,004020 = 0$$

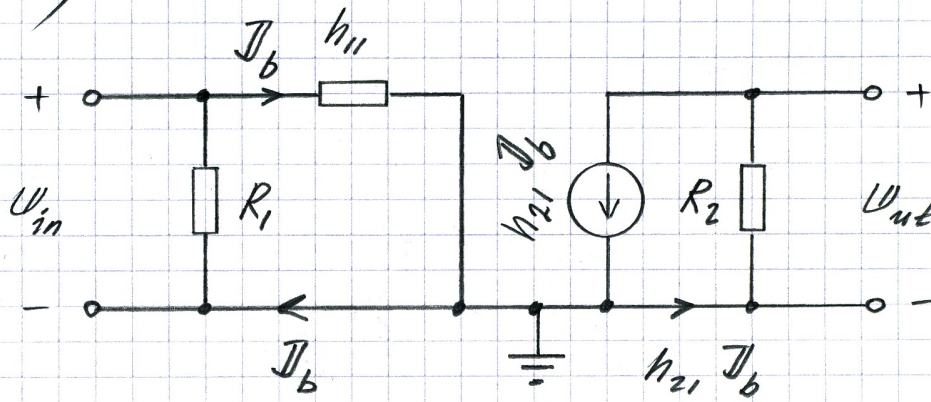
$$\Rightarrow \underline{R_3 \approx 1,0 \text{ k}\Omega}$$

$$+E - R_1 J_B - U_{BE} - R_3 \cdot J_E = 0 \dots (2)$$

$$\Rightarrow 12 - R_1 \cdot 0,000020 - 0,70 - 4,0 = 0$$

$$\Rightarrow \underline{R_1 \approx 0,36 \text{ M}\Omega}$$

4b)



$$U_{out} = -h_{21} I_b R_2$$

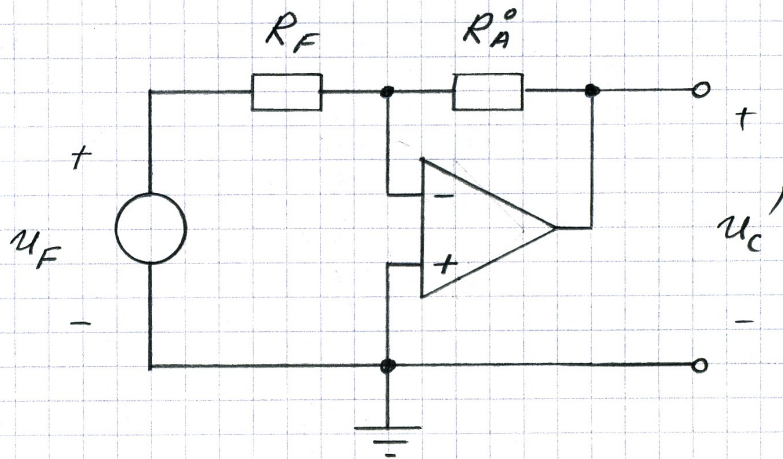
$$U_{in} = h_{11} I_b$$

$$\rightarrow \frac{U_{out}}{U_{in}} = - \frac{h_{21} R_2}{h_{11}} \Rightarrow$$

$$\frac{U_{out}}{U_{in}} = -100$$

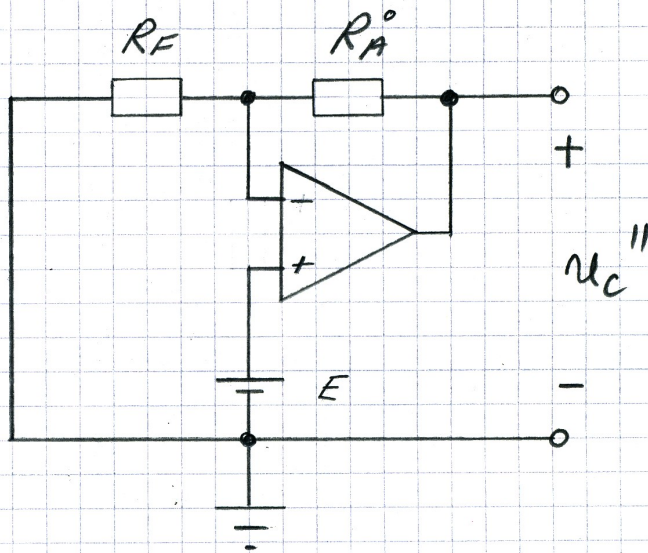
$$Z_{out} = R_2 \rightarrow \underline{Z_{out} = 1,0 \text{ k}\Omega}$$

5. NOLLSTÄLL E , BERÄKNA BIDRAGET FRÅN U_F .



$$U_C' = - \frac{R_A^0}{R_F} \cdot U_F \Rightarrow U_C' = -2U_F$$

NOLLSTÄLL U_F , BERÄKNA BIDRAGET FRÅN U .

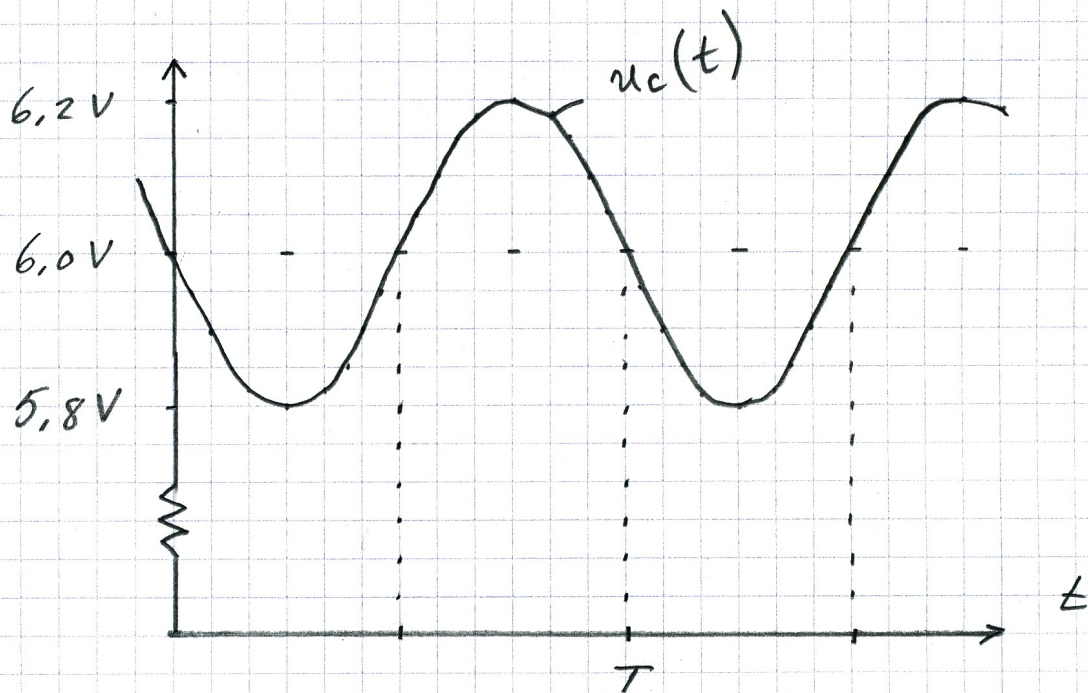


$$U_C'' = E \left(\frac{R_F + R_A^0}{R_F} \right) \Rightarrow U_C'' = 6,0V$$

$$u_c = u_c' + u_c'' =$$

$$= -2 u_F + 6,0 =$$

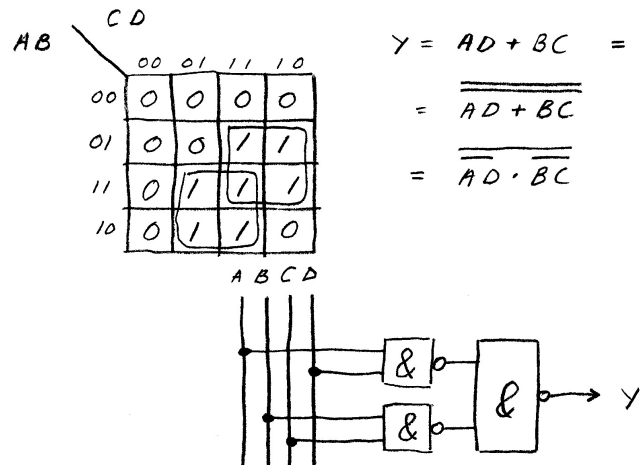
$$= \underline{\underline{6,0 - 0,20 \sin(1000 \cdot t) \text{ V}}}$$



$$\omega = 2\pi f = \frac{2\pi}{T} \rightarrow$$

$$T = \frac{2\pi}{1000} \approx 6,3 \text{ ms}$$

6a)



6b)

$$S = Q_B \oplus Q_C$$

$$R = \overline{Q_B \oplus Q_C}$$

$$T = Q_A \cdot Q_B$$

$$D = Q_B \oplus \overline{Q_A}$$

Q_A	Q_B	Q_C	S	R	T	D	Q_A^+	Q_B^+	Q_C^+
0	0	0	0	1	0	1	0	0	1
0	0	1	1	0	0	1	1	0	1
0	1	0	1	0	0	0	1	1	0
0	1	1	0	1	0	0	0	1	0
1	0	0	0	1	0	0	0	0	0
1	0	1	1	0	0	0	1	0	0
1	1	0	1	0	1	1	1	0	1
1	1	1	0	1	1	1	0	0	1

