1.) 3~ AM KK a) $\eta = \frac{P_N}{\sqrt{3} U_N I_N \cos\varphi_N} = \frac{30\,000\,W}{\sqrt{3} \cdot 380\,V \cdot 62\,A \cdot 0{,}8} =$

$P_N = 30\,kW$

$U_N = 380\,V$ $= 0{,}92$ //

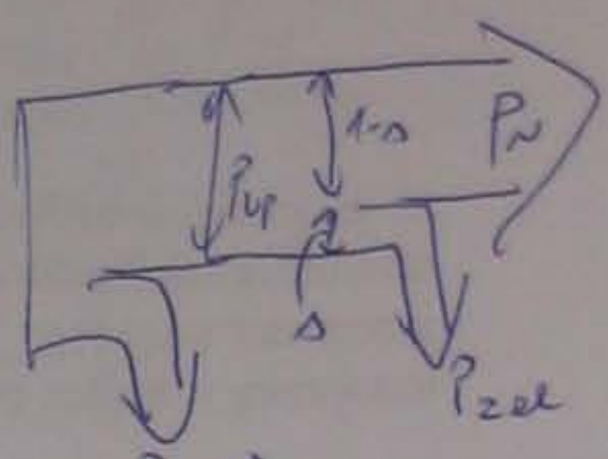
$f = 50\,Hz$

$I_N = 62\,A$

$\cos\varphi_N = 0{,}8$

$n_N = 730\,min^{-1}$

$n_0 / n_N = 2{,}4$



$P_{2el} = s \cdot P_{vp}$

$P_N = (1-s) P_{vp}$ $P_{vp} = \frac{P_N}{1-s_N}$

$P_{2el} = \frac{s_N}{1-s_N} \cdot P_N$ $n_s = \frac{60 f}{p} = 750\,min^{-1}$

$s_N = \frac{n_s - n_N}{n_s} = 0{,}02\overline{6}$

$P_{2el} = \frac{0{,}02\overline{6}}{1-0{,}02\overline{6}} \cdot 30\,kW = 822\,W$ //

a) η, P_{Cu2el}, $P_{Cu+Fe1} = ?$

$P_{vp} = \frac{P_N}{1-s_N} = \frac{30000\,W}{1-0{,}02\overline{6}} = 30822\,W$

masiv. obr. $P_{Fe} = 0$

$P_{Cu1} + P_{Fe1} = P_{1N} - P_{vp} = \sqrt{3} U_N I_N \cos\varphi_N - P_{vp} =$

b) $M = konst.$, mas. obr.

$U_{om} = ?$

$= 1824\,W$ //

b) $M \propto U^2$

NAZ: M_N, U_N

OM: $M_{om} = 2{,}4 M_N$, U_{om}

$\frac{M_N}{M_N} = \frac{U_N^2}{U_{om}^2} = \frac{U_{om}^2}{2{,}4 M_N}$

$U_{om}^2 = 2{,}4 U_N^2$

$U_{om} = U_N$

NAZ: U_N, M_N

OM: M_{om}, U_{om}

PRI U_N je $M_{om} = 2{,}4 M_N$

PRI U'_{om} je $M_{om} = M_N$ (masivno, stalno obremenjen)

$\frac{U_N^2}{U_{om}^{12}} = \frac{2{,}4 M_N}{M_N}$

$U_{om}^{12} = \frac{U_N^2}{2{,}4}$ $U'_{om} = U_N \cdot \sqrt{\frac{1}{2{,}4}} = 380\,V \cdot \sqrt{\frac{5}{12}} = 245\,V$ //

2\. 3f AM drs. obr. $M = k_m I_2 \phi \quad \phi = \phi(I_1)$

$P_N = 5{,}5\,kW$

$U_1 = 380\,V$

$f_1 = 50\,Hz$

$I_{1N} = 13\,A$

$n_N = 945\,min^{-1}$

$E_{20} = 158\,V$

$I_{2N} = 21{,}3\,A$

$M_B = k \cdot n^2$

zmanjšano obr.

$n' = 315\,min^{-1}$

$R_{dod} = ?$

$P_{meh}, P_{2el}, P_{2dod} = ?$

zmanjšano obr.: $I_{1N} = I_1'$ $\Downarrow$ $\phi = konst.$ $\Downarrow$ $M = M(I_2) = k \cdot I_2$

$$\frac{M_B'}{M_B} = \frac{n'^2}{n_N^2} = \frac{I_2'}{I_{2N}}$$

$$I_2' = I_{2N} \frac{n'^2}{n_N^2} = 2{,}3\bar{6}\,A$$

$$I_2 = \frac{s E_{20}}{\sqrt{3} R_2}$$

NAZ: $$R_{2N} = \frac{s_N E_{20}}{\sqrt{3} I_{2N}} = \frac{0{,}055 \cdot 158\,V}{\sqrt{3} \cdot 21{,}3\,A} = \underline{0{,}2355\,\Omega}$$

$$n_s = \frac{3000}{3} = 1000\,min^{-1}$$

$$s_N = \frac{n_s - n_N}{n_s} = 0{,}055$$

$$s' = \frac{n_s - n'}{n_s} = 0{,}685$$

$$R_2' = \frac{s' E_{20}}{\sqrt{3} I_2'} = \frac{0{,}685 \cdot 158\,V}{\sqrt{3} \cdot 2{,}3\bar{6}\,A} = 26{,}4\,\Omega$$

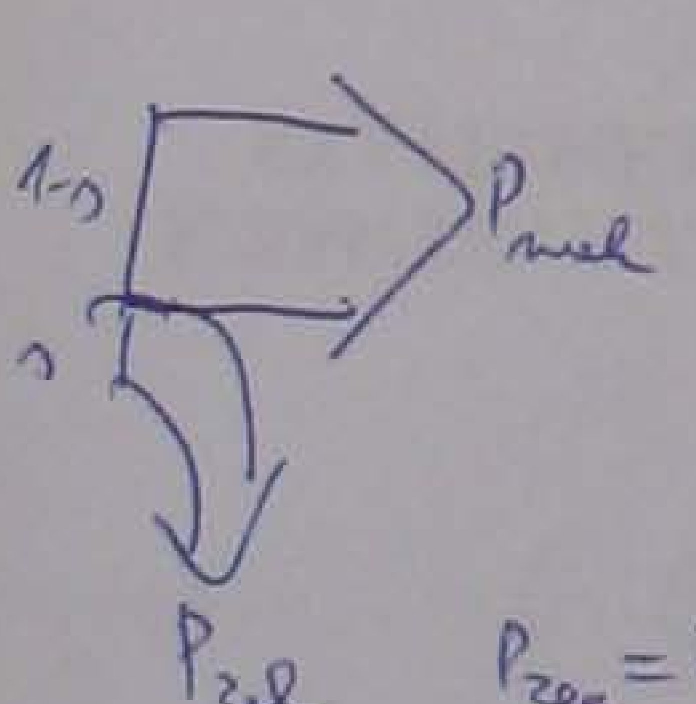
$$R_{2dod} = R_2' - R_{2N} = \underline{\underline{26{,}2\,\Omega}}$$

$$P_{2Cu} = 3 R_{2N} I_2'^2 = 3 \cdot 0{,}2355\,\Omega \cdot 2{,}3\bar{6}^2 A^2 = 3{,}957\ldots W \doteq \underline{\underline{4\,W}}$$

$$P_{2dod} = 3 R_{2dod} I_2'^2 = 3 \cdot 26{,}2\,\Omega \cdot 2{,}3\bar{6}^2 A^2 = \underline{\underline{440\,W}}$$

~~$P_{meh} = P_{2Cu} \frac{1-s'}{s'} = 3{,}957\ldots W \cdot \frac{1-0{,}685}{0{,}685} =$~~

$$P_{2el} = P_{2Cu} + P_{2dod} = \underline{\underline{444\,W}}$$



$$P_{meh} = P_{2el} \frac{1-s'}{s'} = 444 \cdot \frac{1-0{,}685}{0{,}625} = \underline{\underline{204\,W}}$$

$P_{2el} = X \cdot s$

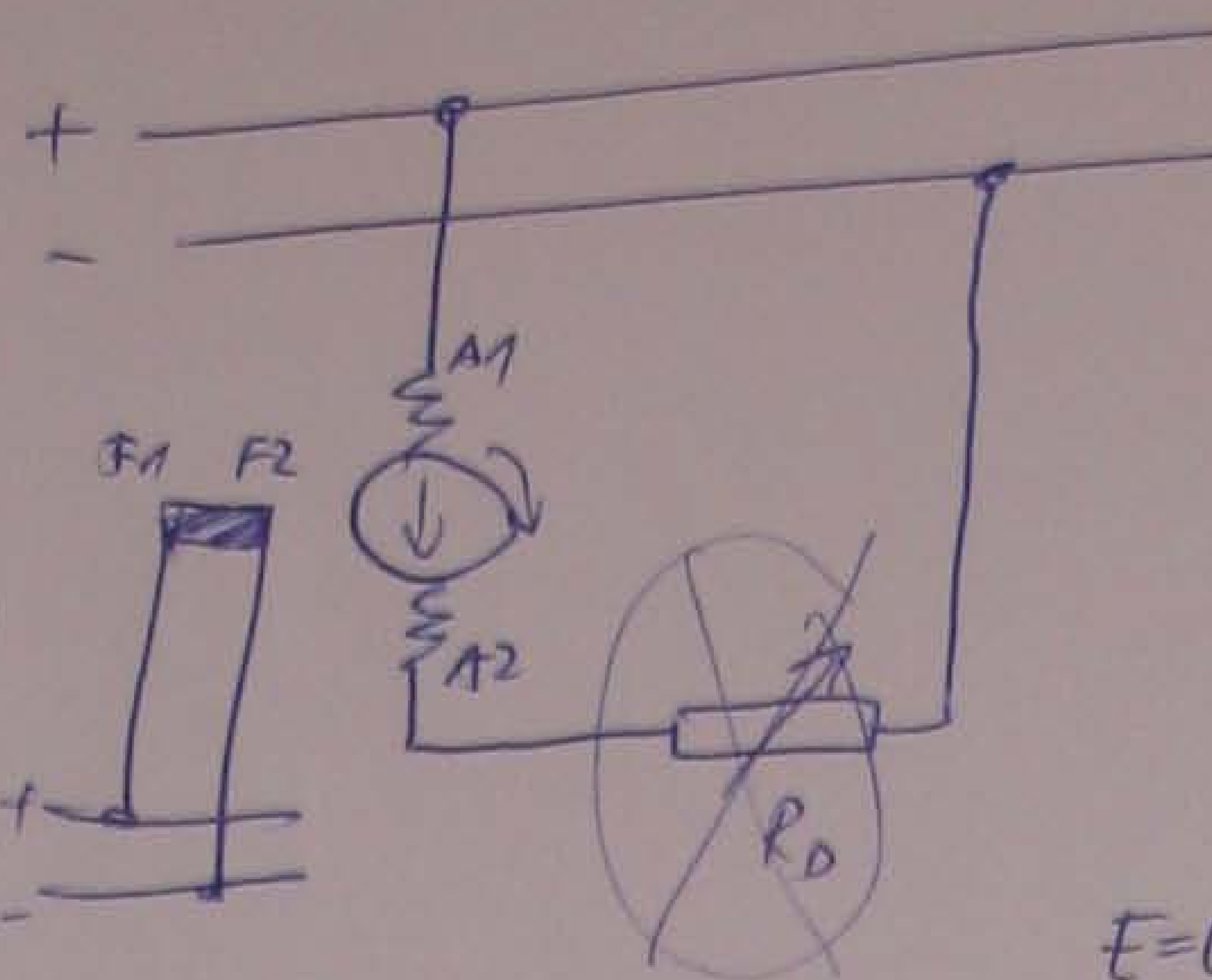
$P_{meh} = X(1-s)$

$P_{meh} = P_{2el} \frac{1-s}{s}$

ali pa: $P = M\omega = M \cdot 2\pi n$ $\quad P_{meh} = P_N \left(\frac{n'}{n}\right)^3 = 5{,}5\,kW \left(\frac{315}{945}\right)^3 =$

$$\frac{P_{meh}'}{P_N} = \frac{M_B' \cdot 2\pi n'}{M_B \cdot 2\pi n} = \frac{k n'^2 2\pi n'}{k n^2 2\pi n} = \frac{n'^3}{n^3} = \underline{\underline{204\,W}}$$

3.) tuje vzb.



$P_N = 55\,kW$

$U_N = 220V$

$n_N = 750\,min^{-1}$

$R_i = 0{,}031\,\Omega$

$I_{iN} = 285A$

$M_B = konst.$

$\Phi = k_\Phi I_v$

$E = k_e \Phi \cdot n$

$M = k_m I_i \cdot \Phi$

$E = U_N - R_i I_i$ ~~$\Delta U_{š}$~~ $= 0$

NAZ: Φ_N, $E \propto n_N \cdot \Phi_N$, $M \propto \Phi_N, I_{iN}$

$'$: Φ', $E' \propto n' \cdot \Phi'$, $M \propto \Phi', I_i'$

$\Rightarrow I_i = I_{iN}$ pri U_N, Φ_N

$\Rightarrow \Phi' = 0{,}8\,\Phi_N$

$E = 220V - 0{,}031\Omega \cdot 285A = 211{,}165V$

$\Rightarrow I_i', n' = ?$

$E' = U_N - R_i I_i'$

$$\frac{E}{E'} = \frac{n_N \Phi_N}{n' \Phi'} = \frac{n_N \Phi_N}{n' \, 0{,}8 \Phi_N}$$

~~$\frac{n_N}{0{,}8 n'} = $~~

$$\frac{0{,}8 n'}{n_N} = \frac{U_N - R_i I_i'}{211{,}165V}$$

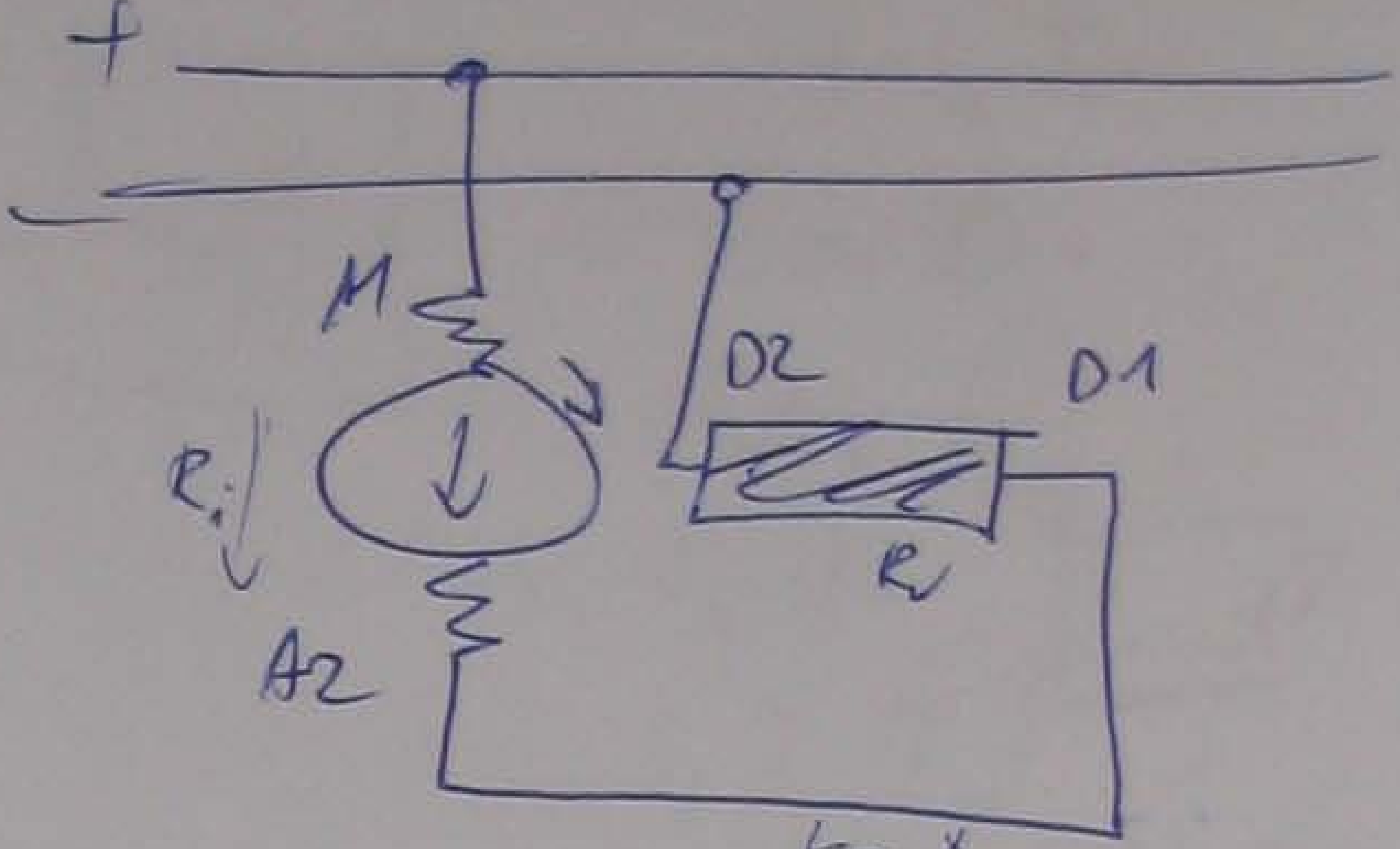
$M = konst.$ $\quad k_m \cdot \Phi_N \cdot I_{iN} = k_m \Phi' I_i'$

$$n' = \frac{n_N}{0{,}8} \cdot \frac{U_N - R_i I_i'}{211{,}\ldots} =$$

$$I_i' = I_{iN} \cdot \frac{\Phi_N}{0{,}8 \Phi_N} = 285A \cdot \frac{1}{0{,}8} = 356{,}25A$$

$$= \frac{750}{0{,}8} \cdot \frac{220V - 0{,}031 \cdot 356}{211{,}165}\,min^{-1} = 927\,min^{-1}$$

4. enosm. KM, ser. vzb.



$R_A + R_v = 0{,}42\,\Omega$

$I_N = 47\,A$

$n_N = 1000\,min^{-1}$

$U_N = 220\,V$

$\Delta U_{šč} = 2\,V$

$U' = 180\,V$ (nar I)

NENASIČEN

$n' = ?$

$$E = U - R_c I - \Delta U_{šč}$$ (konst.)

$\phi = k_\phi \cdot I$ (nenasičen, lin. del magnetilnice)

$$E = k_e \cdot n \cdot \phi = k_e k_\phi \cdot n I$$

$$M = k_m \cdot I \cdot \phi = k_m k_\phi I^2$$

① : U_N, I_N, n_N

② U', I_N, n'

$$\frac{E'}{E} = \frac{n'}{n} \cdot \frac{\phi'}{\phi_N}$$

$$n' = n \frac{U'}{U_N} = 1000 \cdot \frac{180}{220} = 818\,min^{-1}$$

$$E' = U' - R_c I - \Delta U_{šč} = 180V - 0{,}42\,\Omega \cdot 47A - 2V = 158{,}26\,V$$

$$E = U - R_c I - \Delta U_{šč} = 220V - 0{,}42\,\Omega \cdot \ldots = 198{,}26$$

$$n' = n \frac{E'}{E} = 1000 \cdot \frac{158{,}26}{198{,}26} = \underline{798\,min^{-1}}$$