2. (Klausur)

3) ASM

Δ $U_N = 230V$ $I_N = 3A$

$n_n = 1465\ min^{-1}$ $\cos\varphi = 0{,}875$

$P_{FE} = 15W$ $R_1 = 2\Omega$

ges.: $P_{Cu2} = s_n \cdot P_L$

$P_{Cu} = 3 \cdot \frac{3A}{3} \cdot 2\Omega = 6W$

$P_1 = 3 \cdot 230V \frac{3A}{\sqrt{3}} \cdot 0{,}875 = 1045{,}7\ W$

$P_L = P_1 - P_{Cu1} - P_{FE} = 1024{,}7\ W$

$s_n = \frac{1500-1465}{1500} = 0{,}023$

$P_{Cu2} = \underline{24W}$

4) Y $U_N = 400V$ $P = 1$ $f = 50Hz$ $I_1 = 11A$

$\cos\varphi_N = 0{,}84$ $\eta = 88\%$ $R_1 = 0{,}8\Omega$

$P_{FE} = 220W$

a) $P_1 = 3 \cdot U_{Str} I_{Str} \cdot \cos\varphi$

$= \underline{6401{,}7W}$

b) $P_{mech} = P_{ab} = \eta \cdot P_1 = \underline{5633{,}5W}$

c) $P_{Cu1} = 3 \cdot (11A)^2 \cdot 0{,}8\Omega = \underline{290{,}4W}$

$P_L = P_1 - P_{Cu1} - P_{FE} = \underline{5891{,}3W}$

1) a)

$$P_{Cu2} = P_2 - P_{mech} = P_L - P_{ab}$$
$$= \underline{257{,}8\,W}$$

e) $s_n = \frac{n_1 - n_n}{n_n}$ $\frac{P_{Cu2}}{P_L} = \underline{0{,}04}$

f) $M_{el} = \frac{P_L}{2\pi n_1} = \frac{5891{,}3\,W \cdot 60\,s}{2\pi \cdot \frac{60 \cdot 50\,Hz}{1}}$

$$= \underline{18{,}8\,Nm}$$

2) 15M gegs. S_K & M_A

$$M_N = \frac{P_N}{2\pi n_n} \qquad n_1 = \frac{60 \cdot 50}{4} = 750$$

$$= \frac{10\,kW \cdot 60}{2\pi \, 712{,}5} \qquad n_n = 750\,(1 - 0{,}05)$$

$$= 712{,}5$$

$$= 134{,}2\ Nm$$

$S_{K1,2}$ ≠ $\frac{M_K}{M_N}$ $\frac{S_N}{S_K}$

$$2 \cdot \frac{M_K}{M_N} = \frac{S_N}{S_K} + \frac{S_K}{S_N} = \frac{S_N^2 + S_K^2}{S_K S_N}$$

$$0 = S_K^2 - S_K \left(S_N \, 2 \cdot \frac{M_K}{M_N} \right) + S_N^2$$

$$0 = S_K^2 - 0{,}26\, S_K + (0{,}05)^2$$

$$S_{K1,2} = \frac{0{,}26}{2} \pm \sqrt{\left(\frac{0{,}26}{2}\right)^2 - (0{,}05)^2}$$

$$S_{K1} = 0{,}01 \qquad S_K > S_N$$

$$S_{K2} = 0{,}25$$

$$\Rightarrow \quad S_K = 0{,}25$$

$$M_A = \frac{\frac{0{,}05}{0{,}25} + \frac{0{,}25}{0{,}05}}{\frac{1}{0{,}25} + 0{,}25} \cdot 134\ Nm$$

$$= 16\,\text{[illegible]}\ Nm$$

2. Klausur

5) Synchrongenerator

$p = 2$ $\qquad U_{1\varphi} = \frac{10{,}5\,kV}{\sqrt{3}} = 6\,kV$ $\qquad \varphi = 29{,}54$

a) $S_N = 3 \cdot U_1 \cdot I_1$

$$I_1 = \frac{S_N}{3 U_1} = \frac{180\,MVA}{3 \cdot \frac{10{,}5\,kV}{\sqrt{3}}} = 9{,}897\,kA$$

$Re\{\underline{I}_1\} = 9{,}897\,kA \cdot (-0{,}87)$

$= -8{,}61\,kA$

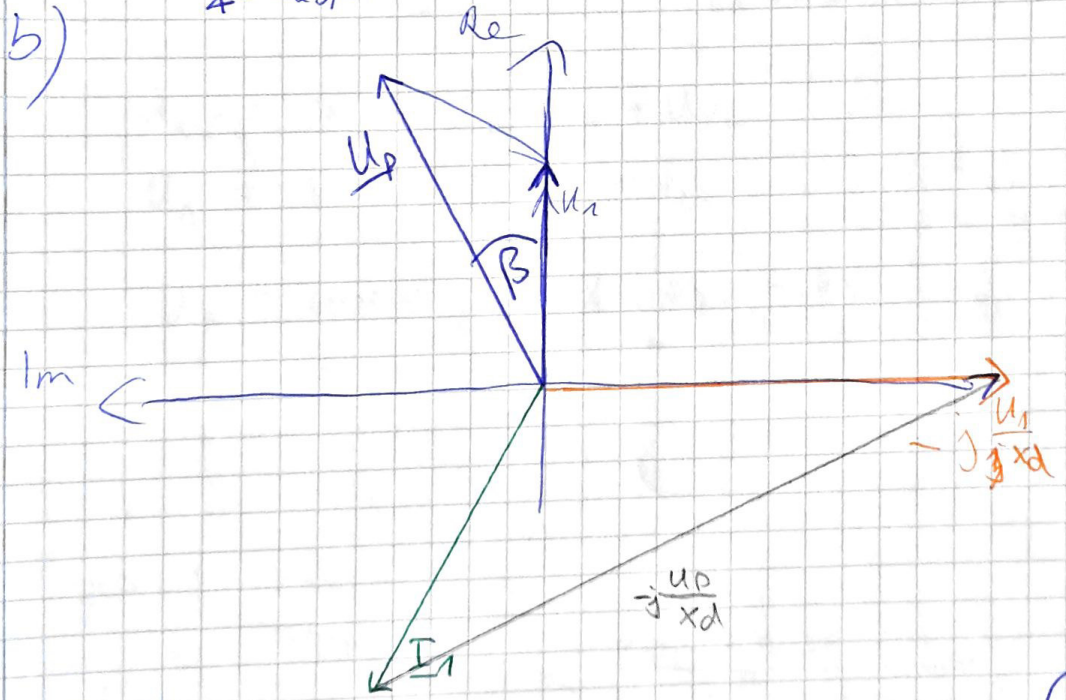
$Im\{\underline{I}_1\} = 4{,}88\,kA$

$\underline{I}_1 = -8{,}61\,kA + j\,4{,}88\,kA$

$\varphi = -29{,}54$

Oder übersetzt $I_1(-\cos\varphi + j\sin\varphi)$

b)



2 kA/cm
2 kV/cm

$-j\frac{U_1}{x_d} = 12{,}124\,kA$

c) $\beta = 27°$

$\underline{U}_p = \underline{U}_1 - j x_d \cdot \underline{I}_1 = 6\,kV - j\,0{,}552 \cdot (-8{,}61\,kA + j\,4{,}88\,kA)$

$= 6\,kV + j\,4{,}305 + 2{,}44$

$= 8{,}44\,kV + j\,4{,}305 = 9{,}5\,kV\,e^{j27°}$

$$\varepsilon = \frac{U_p}{U_1} = \frac{6\,kV}{9{,}5 \cdot \cancel{10^3}} = 1{,}58$$

über