Opgave 1 Mohan 5-14 (blz. 5-34)

open circuit: $V_{OC} = 240V$, $I_{OC} = 5.0A$, $P_{OC} = 400W$.

$$R_{he} = \frac{V_{OC}^2}{P_{OC}} = \frac{240^2}{400} = 144\Omega.$$

$$|Z_{OC}| = \frac{X_m R_{he}}{\sqrt{R_{he}^2 + X_m^2}} = \frac{V_{OC}}{I_{OC}} = \frac{240}{5} = 48\Omega.$$

$$X_m^2.R_{he}^2 = Z^2 R_{he}^2 + Z^2 X_m^2 = 2304.R_{he}^2 + 2304.X_m^2$$

$$X_m^2 = \left(R_{he}^2 - 2304\right) = 2304.R_{he}^2$$

$$X_m = \sqrt{\frac{2304.144^2}{144^2 - 2304}} = 50.91\Omega$$

short circuit: $V_{SC} = 90V$, $I_{SC} = 20A$, $P_{SC} = 700W$.

$$R_{2HV} = \frac{1}{2}.\frac{P_{SC}}{I_{SC}^2} = \frac{1}{2}.\frac{700}{20^2} = 0{,}875\Omega. \Rightarrow (5\text{-}52)$$

$$R_{1L} = \left(\frac{240}{2400}\right)^2 \times R_2 = 0{,}00875\Omega$$

$$|Z_{SC}| = \sqrt{(2R_2)^2 + (2X_{l2})^2} = \frac{V_{SC}}{I_{SC}} \Rightarrow (5\text{-}54)$$

$$(2X_{l2})^2 = \left(\frac{90}{20}\right)^2 - (2R_2)^2 = 17.188$$

$$X_{L2HV} = 2.07\Omega$$

$$X_{L1LV} = \left(\frac{240}{2400}\right)^2 \times X_1 \cong 0.02\Omega.$$

Opgave 2 Mohan 7-7 (blz. 7-31)

$\omega_{m_1} = 1500rpm = 157.08rad/s$

$\omega_{m_2} = 750rpm = 78.54rad/s$

$J_{eq} = J_m + J_L = 00.2 + 0.04 = 0.06kgm^2$

1) $T_{em,bracking} = k_T|I_a| = 0.5 \times 10 = 5Nm$

2) $P_{loss} = R_a I_a^2 = 0.35 \times 10^2 = 35W$

$$\Delta E = \frac{1}{2} J_{eq}\left[\omega_{m_1}^2 - \omega_{m_2}^2\right] = \frac{1}{2} \times 0.06\left[157.08^2 - 78.54^2\right] = 555.17J$$

$$\frac{d\omega_m}{dt} = -\frac{T_{em}}{J_{eq}}$$

$$\therefore \omega_m(t) = \omega_{m1} - \frac{T_{em}}{J_{eq}}t;\ \omega_{m2} = \omega_{m1} - \frac{T_{em}}{J_{eq}}\Delta t$$

$$\text{or } \Delta t = (\omega_{m1} - \omega_{m2})\frac{J_{eq}}{T_{em}} = (157.08 - 78.54)\frac{0.06}{5} = 78.54 \times \frac{0.06}{5} = 0.942s$$

3) $E_{loss} = R_a I_a^2 \Delta t = 0.35 \times 10^2 \times 0.942 = 32{,}97J$

4) $E_{recoverd} = \Delta E_{total} - E_{loss} = 555.17 - 32.97 \approx 522J$

Opgave 3 Mohan 11-10 (blz. 11-47)

$$\bar{V}_a = \frac{208}{\sqrt{3}}\angle 0° = 120\angle 0° V$$

1) $$Z = (R_s + jX_{ls}) + \frac{(jX_m)(jX'_{lr} + R'_r/s)}{\frac{R'_r}{s} + j(X_m + X'_{lr})} = (0.5 + j0.6) + \frac{(j28.5)(j0.83 + 11.25)}{11.25 + j(29.33)} = 10.95\angle 26.9\Omega$$

$$\bar{I}_a = \frac{\bar{V}_a}{Z} = \frac{120\angle 0°}{10.95\angle 26.9°} = 10.96\angle -26{,}9° A;$$

2) $\therefore I_{rms} = 10.96A$

3) $PF = \cos(26.9°) = 0{,}89$ (inductief)

$$\bar{I}'_{ra} = I_a \frac{jX_m}{\frac{R'_r}{s} + j(X_m + X'_{lr})} = 9{,}94\angle -5{,}9° A$$

4) $P_r = 3.R'_r(I'_{ra})^2 = 133{,}4W$

5) $n_m = n_{syn}(1-s) = (60 \times 60) \times (1 - 0.04) = 3456 omw/\min$

Vraag 1

Schijnbaarvermogen => V*A in VA // $S = P + jQ$
Blindvermogen => VA*sinρ in Var // Q
Wattvermogen => VA*cosρ in Watt // P

Vraag 2

Uitgangsspanning is afhankelijk van de aansnij hoek α

Enkelfasig $V_d = 0.9V_s \cos\alpha$

Dubbelfasig $V_d = 1.35V_s \cos\alpha$

Vraag 3

1 – vier
2 – twee
3 – zie figuur 16-20
4 – zie figuur 16-26

Vraag 4

1 – figuur 16-15a

2 – $V_d > \hat{V}_s$

3 – figuur 16-15b

Vraag 5

$$\hat{V} = V_{eff} \times \sqrt{2} = 325V$$

1 – Zonder condensator: $V_{out} = \hat{V} \times \frac{2}{\pi} = 207V$

2 – Met condensator: $V_{out} = \hat{V} = 325V$

Zie formuleblad –Wisselspanning