ETS20A – 1º semestre de 2013 – Prova 02

Questão 01

b) $V_{BT} = 120V \ (a=20) \Rightarrow V_{AT} = 20 \times 120 = 2400V$

a) $S_n = 2400 \times 20{,}833 = 49999{,}20 \ (50\,kVA)$

c) $Perdas = 396 + 810 = 1206\,W$

$$\eta = \frac{50000 - 1206}{50000} = 97{,}588\%$$

d) $$R_p = \frac{120^2}{396} = 36{,}364\,A \ (\text{lado de BT})$$

$$R_{pAT} = 36{,}364 \times 400 = 14545{,}600\,\Omega$$

$$I_p = \frac{120}{36{,}364} = 3{,}300\,A, \quad I_m = \sqrt{9{,}65^2 - 3{,}300^2} = 9{,}068\,A$$

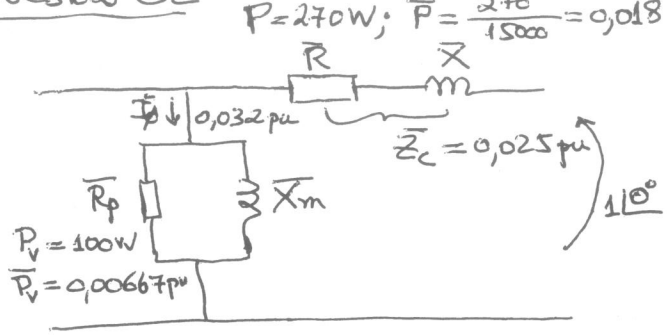
e) $$X_m = \frac{120}{9068} = 13{,}233\,\Omega \ (\text{lado de BT})$$

$$X_{mAT} = 13{,}233 \times 400 = 5293{,}200\,\Omega$$

f) $$R_{AT} = \frac{810}{20{,}833^2} = 1{,}866\,\Omega \ (\text{lado de AT})$$

g) $$Z_{AT} = \frac{92}{20{,}833} = 4{,}416\,\Omega, \quad X_{AT} = \sqrt{Z_{AT}^2 - R_{AT}^2} = 4{,}002\,\Omega$$

Questão 02



a) $\bar{P}_v = 100/15000 = 0{,}00667\ pu$

$$\bar{R}_p = \frac{1^2}{0{,}00667} = 149{,}925\ pu$$

b) $$\bar{I}_p = \frac{\bar{V}}{\bar{R}_p} = \frac{1}{149{,}925} = 0{,}00667\ pu$$

$$\bar{I}_m = \sqrt{\bar{I}_\phi^2 - \bar{I}_p^2} = \sqrt{0{,}032^2 - 0{,}00667^2} = 0{,}0313\ pu$$

$$\bar{X}_m = \frac{1}{\bar{I}_m} = \frac{1}{0{,}0313} = 31{,}949\ pu$$

c) $\bar{R} = \bar{P}/\bar{I}^2 = 0{,}018/1^2 = 0{,}018\ pu$

d) $$\bar{X} = \sqrt{\bar{Z}_c^2 - \bar{R}^2} = \sqrt{0{,}025^2 - 0{,}018^2} = 0{,}01735\ pu$$

e) $$\eta = \frac{1 - perdas}{1} = \frac{1 - 370/15000}{1} = 97{,}533\%$$

f) $I_m = 0{,}0313\ pu$ (calculada acima)

g) $$\bar{V} = 1\angle 0° + (0{,}018 + j\,0{,}01735)\,1\angle 25{,}842 = 1\angle 0 + 0{,}0250\angle 43{,}947° \cdot 1\angle 25{,}842 =$$

$$= 1 + 0{,}025\angle 69{,}789 = 1 + 0{,}00863 + j\,0{,}02346 = 1{,}00863 + j\,0{,}02346 =$$

$$= 1{,}0089\angle 1{,}332°\ V$$

$$R = \frac{1,0089-1}{1} = 0,0089 = 0,89\%$$

Questão 03

As perdas ferro se mantem aproximadamente constantes mesmo variando a carga. Dessa forma P_f é constante.

Na condição de plena carga as perdas no cobre são:

$$P_{cu1} = RI^2$$

Na condição de 50% de carga as perdas cobre serão:

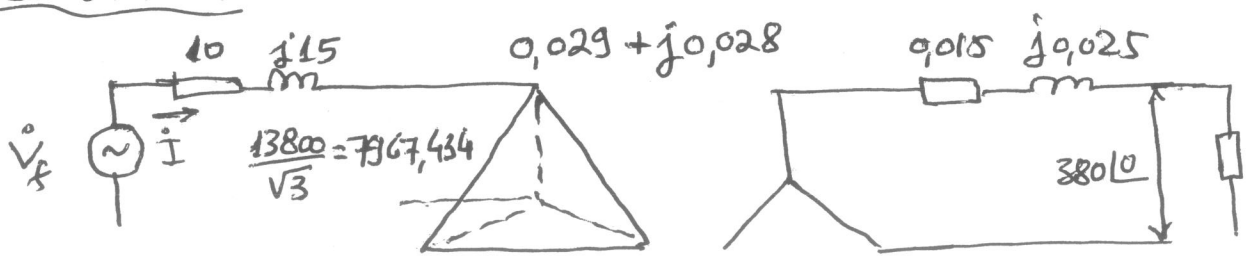
$$P_{cu2} = R(0,5)^2 I^2 = 0,25 I^2$$

$400000 \times 0,8 \times (1-0,9877)$

Dessa forma $\begin{cases} P_{cu1} + P_f = 3936 \\ 0,25 P_{cu1} + P_f = 1740 \end{cases} \Rightarrow \begin{matrix} P_{cu1} = 2928\,W \\ P_f = 1008\,W \end{matrix}$

$200000 \times 1 \times (1-0,9913)$

Questão 04



$$\dot{I} = \frac{45000}{\sqrt{3} \times 13800} = 1,883\,A$$

$$\frac{380}{\sqrt{3}} = 219,393$$

$$\frac{0,029 + j\,0,028}{(219,393)^2}\left(\frac{13800}{\sqrt{3}}\right)^2 = 38,246 + j\,36,927$$

$$\frac{0,015 + j\,0,025}{(219,393)^2}\left(\frac{13800}{\sqrt{3}}\right)^2 = 19,782 + j\,32,971$$

$$\frac{10 + j15}{68,028 + j\,84,898}$$

$$\dot{V}_f = 7967,434 + (68,028 + j84,898)\,1,883\,\angle -36,87^\circ =$$

$$= 7967,434 + 108,791\,\angle 51,295 \cdot 1,883\,\angle -36,870^\circ = 8165,988\,\angle 9358^\circ$$

a) $V = \sqrt{3}\,8165,988 = 14143,906\,V$

b) $R = \frac{14143,906 - 13800}{13800} = 2,492\%$