ALaifa//M1:Res+Elt+Cde//Corrigé Examen 2024

Exercice 1

$$L = 2.10^{-7} Ln\frac{GMD}{GMR_L} \qquad C = \frac{2\pi\varepsilon}{Ln\left(\frac{GMD}{GMR_C}\right)}$$

$$GMD = \sqrt[3]{D.D.2D} = \sqrt[3]{2D^3} = 1{,}26D = 1{,}26 \times 6 = 7{,}56m$$

$$GMR_L = \sqrt{GMR.d} = \sqrt{1{,}148 \times 30} = 5{,}869\ cm$$

$$GMR_C = \sqrt{r.d} = \sqrt{1{,}42 \times 30} = 6{,}527\ cm$$

$$L = 2.10^{-7} Ln\frac{756}{5{,}869} = 9{,}717.10^{-7}\ \ H/m = 0{,}972\ mH/km$$

$$C = \frac{2\pi.8.854.10^{-12}}{Ln(\frac{756}{6{,}527})} = 11{,}71\ .10^{-12}\ F/m = 11{,}71.10^{-9} F/km$$

$$R = \left(\frac{R_1}{2}\right) l = \frac{0{,}08}{2} \times 120 = 4{,}8\ \Omega$$

$$X = (\omega L) l = 314 \times 0{,}972.10^{-3} \times 120 = 36{,}62\ \Omega$$

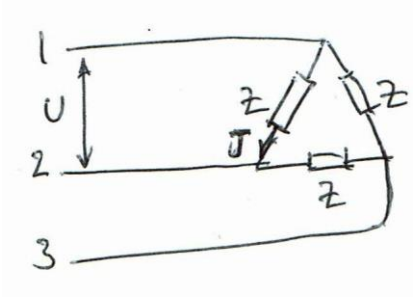
$$Z = R + jX = 4{,}8 + j36{,}62 = 36{,}93\angle 82{,}53°\ \Omega$$

Exercice 2

$$Z = 12 + j15 = 19{,}21\angle 51{,}34°\ \Omega$$

1)

$$J = \frac{U}{Z} = \frac{400}{19{,}21} = 20{,}82\ A$$



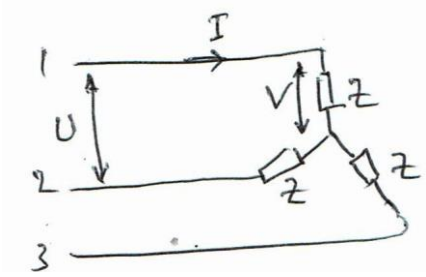
$$P = 3RJ^2 = 3 \times 12 \times (20{,}82)^2 = 15605W \approx 15{,}61\ kW$$

$$Q = 3XJ^2 = 3 \times 15 \times (20{,}82)^2 = 19506VAr \approx 19{,}51\ kVAr$$

$$S = \sqrt{P^2 + Q^2} = \sqrt{22{,}18^2 + 14{,}78^2} = 24{,}98\ kVA$$

2)

$$I = \frac{V}{Z} = \frac{U/\sqrt{3}}{Z} = \frac{400/\sqrt{3}}{19{,}21} = 12{,}02\ A$$



$$P = 3RI^2 = 3 \times 12 \times (12{,}02)^2 = 5201W \approx 5{,}20\ kW$$

$$Q = 3XI^2 = 3 \times 15 \times (12{,}02)^2 = 6502Ar \approx 6{,}50\ kVAr$$

$$S = \sqrt{P^2 + Q^2} = \sqrt{5{,}20^2 + 6{,}50^2} = 8{,}33\ kVA$$

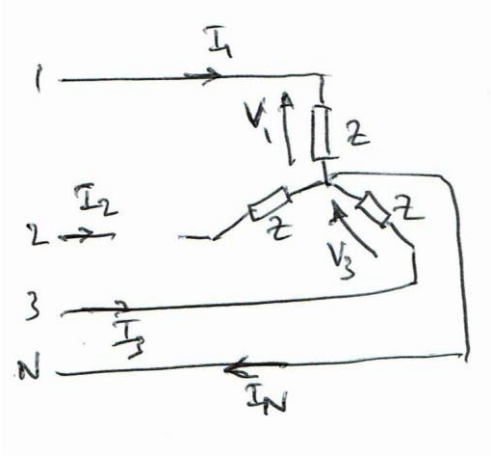
3)

$$I_2 = 0$$

$$\bar{I_N} = \bar{I_1} + \bar{I_3} = \frac{\bar{V_1}}{Z} + \frac{\bar{V_3}}{Z} = \frac{\bar{V_1}}{Z} + \frac{\bar{V_1}\angle 120°}{Z}$$

$$\bar{V_1} = \frac{400}{\sqrt{3}}\angle 0° = 231\angle 0°\ V$$

$$\bar{I_N} = \frac{231 + 231\angle 120°}{19{,}21\angle 51{,}34°} = 12{,}02\angle 8{,}66°\ A$$



Exercice 3

$$\overline{U_S} = 360\angle 10°kV \quad \overline{U_R} = 375\angle 0°kV$$

$$\bar{I} = \frac{\bar{V_S} - \bar{V_R}}{Z} = \frac{\overline{U_S} - \overline{U_R}}{\sqrt{3}.Z} = \frac{360\angle 10° - 375\angle 0°}{\sqrt{3}.(4 + j32)} = 1177{,}6\angle 25{,}26°\ A$$

$$\bar{S_S} = \sqrt{3}.\overline{U_S}.\bar{I}^* = \sqrt{3}.360\angle 10°.(1{,}1776\angle 25{,}26°)^* = 734{,}28\angle -15{,}26°\ MVA$$

$$\rightarrow \quad P_S = 708{,}39\ MW \quad Q_S = -193{,}26\ MVAr$$

$$\overline{S_R} = \sqrt{3}.\overline{U_R}.\bar{I}^* = \sqrt{3}.375\angle 0°.(1{,}1776\angle 25{,}26°)^* = 764{,}87\angle -25{,}26°\ MVA$$

$$\rightarrow \quad P_R = 691{,}74\ MW \quad Q_S = -326{,}39\ MVAr$$

$$\Delta P = P_S - P_R = 708{,}39 - 691{,}74 = 16{,}65\ MW$$