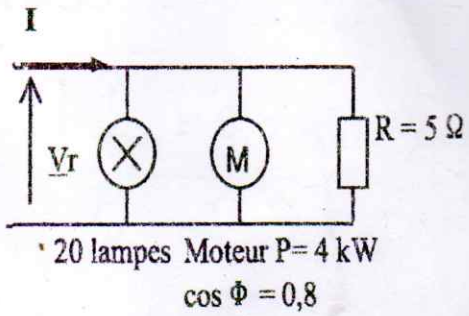
Ministry of Higher Education and Scientific Research
Badji Mokhtar - Annaba University
Faculty of Technology
Department ST
Durée:1H30

2024/2025

EXAM S3 : Electrotechnique fondamentale 1

EX:01 : (6Pts)



The power of a single lamp is 260W and Vr=110V

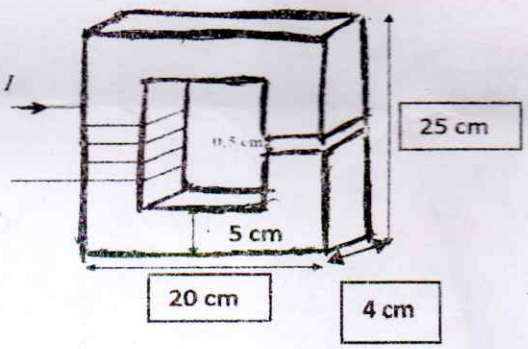
a)- What are **the active and reactive** powers consumed by the installation?

b)- What is the **power factor**?

c)- What is the effective intensity of the **current** (I) in the line cable?

EXE 01 : (8Pts)

$\mu_0=4\pi\ 10^{-7}$ H/m



Consider the following circuit, the current intensity is 2 A, the relative permeability of the material is μ_r=2500 with an air gap thickness of 0.5 cm, the number of turns is 250.Knowing that the depth is 4 cm, calculate:

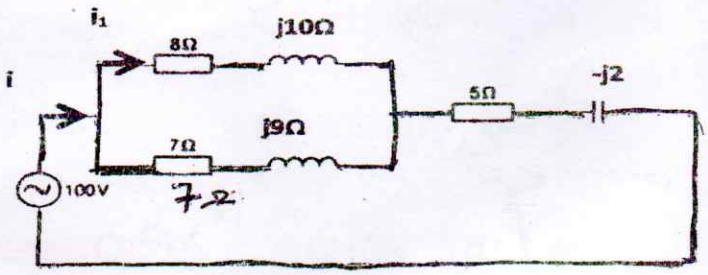
a)-Calculate the reluctance of this circuit (material and air gap) and calculate the magnetic flux ? Give the equivalent electrical diagram?

b)- Indicated what this information corresponds to, taken from the nameplates of two transformers: **Yy6 and Dy5**

EXE 03 : (6Pts)

We consider the circuit represented in the figure 03 . Knowing that V(t)= 220 √2sin314t.

1- Calculate the impedances of each branch
2- Calculate the equivalent impedance (Z_{eq}) and the current i(t),
3- What is the nature of the charge



Dr HOUDELBOURK.S

Dr Ghoudelbourk Sihem:

ELTF : 01

S_3

EXO 1 (6pts)

P (1) lampe : 2600 w $P_{20\,lampe} = 20 \times 2600 = 5{,}2\,Kw$

$P_M = 4\,Kw$

$P_{L20} = 5{,}2\,Kw$

$P_R = \frac{U^2}{R} = 2{,}42\,Kw$

$P_R = 2{,}42\,Kw$

$P_T = P_{L20} + P_M + P_R = 11{,}62\,Kw$

$P_T = 11{,}62\,Kw$ 2pts

$Q_T = Q_{L20} + Q_M + Q_R = Q_M$

$Q_T = 3 \cdot 10^{+3}\,VAR$ 2pts

$Q_M = ?$ $P_M = UI\cos\varphi$ $UI = \frac{P}{\cos\varphi}$

$Q_M = UI\sin\varphi$ $\sin\varphi = 0{,}6$

$Q_M = \frac{P\sin\varphi}{\cos\varphi} = 3 \cdot 10^{+3}\,VAR$

b)

$P_T = UI_T\cos\varphi_T$ $tg\,\varphi = \frac{Q_T}{P_T} = \frac{3}{11{,}62} = 0{,}258$

$Q_T = UI\sin\varphi_T$

$\varphi_T = 14{,}47°$

1pts $\cos\varphi_T = 0{,}96$ Power factor

c) $I_T = ?$ $P_T = UI_T\cos\varphi$ $I_T = \frac{P_T}{U\cos\varphi_T} = 110\,A$

$I_T = 110\,A$ 1pts

EY02 (8pts)

$R_H = ?$, $R_0 = ?$

$S = 4 \times 5 = 20\,cm^2 = 0,002\,m^2$ 1p

$l_{moy} = (20 - 5 + 25 - 5)\,2 = 70\,cm = 0,7\,m$ 1pt

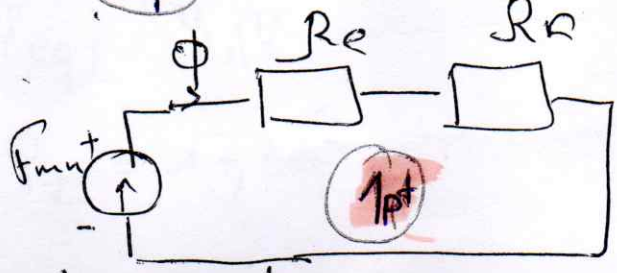
$$R_H = \frac{l_{moy}}{\mu_0 \mu_r S} = \frac{0,7}{4.10^{-7}.\pi.2500 \times 2.10^{-3}} = 111400\ At/wb$$

$R_H = 111400\ At/wb$ 1

$$R_0 = \frac{e}{\mu_r S} = \frac{0,15 \times 10^{-2}}{4\,10^{-7}\,\pi\,2.10^{-3}} = 1989436,7\ At/wb$$ 1

$R_T = R_H + R_0 = 2100836,78\ At/wb$.

$$\Phi = \frac{NI}{R_T} = 0,238 \times 10^{-3}\ wb$$ 1pts



b)

1/ Yd Transformateur abaisseur

Primaire haute tension couplage en étoile

Secondaire y Basse Tension couplage en étoile Sta

$6 \times 30° = 180°$ 1pts

indice horaire (decalage Secondaire Primaire)

Dy : 5

D Primaire haute tension couplage en triangle 1pt

y Secondaire Basse Tension Couplage en étoile

EXO 3 (6 pts)

1) $v = 220\sqrt{2}\sin 314t$ (1)

$\underline{Z_1} = 8 + j10\Omega$

$\underline{Z_2} = 7 + 9j$ (1)

$\underline{Z_3} = 5 - 2j$ (1)

2) $\underline{Z_{eq}} = (\underline{Z_1} \,//\, \underline{Z_2})$ en Serie avec $\underline{Z_3}$

$$\underline{Z_{eq}} = \frac{\underline{Z_1}\,\underline{Z_2}}{\underline{Z_1}+\underline{Z_2}} + \underline{Z_3} = \frac{(8+j10)(7+9j)}{15+19j}\cdot\frac{(15-19j)}{(15-19j)} + 5 - 2j$$

$$= \frac{2188 + 2776j}{225+361} + 5 - 2j = 8{,}73 + 2{,}73j$$

$$\underline{Z_{eq}} = 8{,}73 + j\,2{,}73 \quad (1)$$

$\varphi_Z =$

$|I| = \dfrac{U}{|Z_{eq}|} = 24\ A$

$|\underline{Z_{eq}}| = 9{,}14$

$\varphi_I = -\varphi_Z = -17{,}36°$ $\qquad \varphi_Z = 17{,}36°$

$$i(t) = 24\sqrt{2}\sin(314t - 17{,}36°) \quad (1)$$

$I = 24\, e^{-j17{,}36}$

3) $\underline{Z} = 8{,}73 + j2{,}73$ la charge est inductive

la partie Imaginaire est > 0

2,73 (1)