

PHYSIQUE APPLIQUEE (ELT)

1/ 1.1 Calcul de i_{ex_0}

1

$$i_{ex_0} = \frac{U}{R_{hex} + r} = \frac{140}{200 + 100} \Rightarrow \boxed{i_{ex_0} = 0,7 A}$$

4pts

1.2 - Calcul de I_0 dans l'induit

$$P_c = E_0 I_0 = C_p \cdot \Omega \Rightarrow I_0 = \frac{C_p \cdot \Omega}{E_0}$$

$$I_0 = \frac{C_p \cdot 2\pi N}{E_0} ; i_{ex} = 0,7 A \Rightarrow E = 105 V \bar{a}$$

$$N = 1500 \text{ tr/mn.}$$

7pts

$$I_0 = \frac{1,681 \cdot 2\pi \times 1500}{60 \times 105} \Rightarrow \boxed{I_0 = 2,515 A}$$

1.3 - Calcul de la fréquence de rotation N_0

$$U = E_0 + R_a I_0 \Rightarrow E_0 = U - R_a I_0 = 140 - 0,5 \times 2,515$$

$$E_0 = 138,743 V$$

$$\frac{E_0}{E} = \frac{N_0}{N} \Rightarrow N_0 = \frac{E_0}{E} \cdot N = \frac{138,743}{105} \times 1500$$

$$\boxed{N_0 = 1982,042 \text{ tr/mn.}}$$

7pts

1.4 - Calcul de P_c

$$P_c = C_p \cdot 2\pi N_0 = 1,681 \times 2\pi \times \frac{1982,042}{60}$$

$$\boxed{P_c = 348,91 W}$$

7pts

2/

2.1 - Calcul de I dans l'induit

$$\begin{aligned}
 P_c + P_u = EI \\
 E = U - R_a I
 \end{aligned}
 \left. \vphantom{\begin{aligned} P_c + P_u = EI \\ E = U - R_a I \end{aligned}} \right\} P_c + P_u = EI = (U - R_a I) I$$

$$P_c + P_u = (U - R_a I) I$$

$$UI - R_a I^2 - P_c - P_u = 0$$

$$R_a I^2 - UI + P_c + P_u = 0$$

$$0,5 I^2 - 140 I + 3548,91 = 0 \text{ or } I_N = 30 \text{ A}$$

d'où $I = 28,188 \text{ A}$ (9pts)

2.2 - calcul de N.

$$i_{ex} = \frac{U}{F} = \frac{140}{100} = 1,4 \text{ A} \Rightarrow E' = 125 \text{ V et } N' = 1500 \text{ tr/mn}$$

$$U = R_a I + E \Rightarrow E = U - R_a I = 140 - 0,5 \times 28,188$$

$$E = 125,906 \text{ V}$$

$$\frac{E}{E'} = \frac{N}{N'} \Rightarrow N = \frac{E}{E'} \cdot N' = \frac{125,906}{125} \cdot 1500$$

$N = 1510,872 \text{ tr/mn}$ (6pts)

2.3 - Calcul du couple utile C_u .

$$C_u = \frac{P_u}{2\pi N} = \frac{3200 \times 60}{2\pi \times 1510,872} \Rightarrow$$

$C_u = 20,225 \text{ N.m}$ (7pts)

2.4 - Calcul du rendement η

$$\eta = \frac{P_u}{P_a} = \frac{P_u}{U(I + i_{ex})} = \frac{3200}{140(28,188 + 1,4)}$$

$$\eta = \frac{3200}{4142,32}$$

$$\Rightarrow \boxed{\eta = 0,7725 \text{ soit } 77,25\%}$$

8pts

3/

3.1 - Calcul de la tension U.

$$i_{ex} = 1,1 \text{ A} \Rightarrow E = 115 \text{ V}$$

$$U = R_a I + E = 0,15 \times 30 + 115$$

$$\boxed{U = 130 \text{ V}}$$

9pts

3.2 - Calcul de R_{hex}

$$R_{hex} + r = \frac{U}{i_{ex}} \Rightarrow R_{hex} = \frac{U}{i_{ex}} - r$$

$$R_{hex} = \frac{130}{1,1} - 100 \Rightarrow \boxed{R_{hex} = 18,182 \Omega}$$

8pts

3.3 - Calcul de P_u

$$P_u = P_a - P_{Jex} - P_{Jind} - P_c = UI + U i_{ex} - R_a I^2 - U i_{ex} - P_c$$

$$P_u = 130 \times 30 + 130 \times 1,1 - 0,15 \times 30^2 - 348,94 - 130 \times 1,1$$

$$\boxed{P_u = 3101,096 \text{ W}}$$

8pts