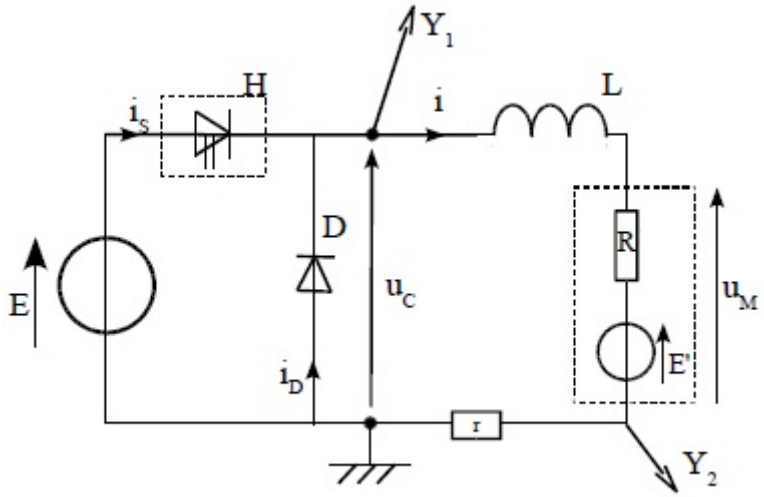
Faculté de Technologie

Département de Génie Electrique et Electronique

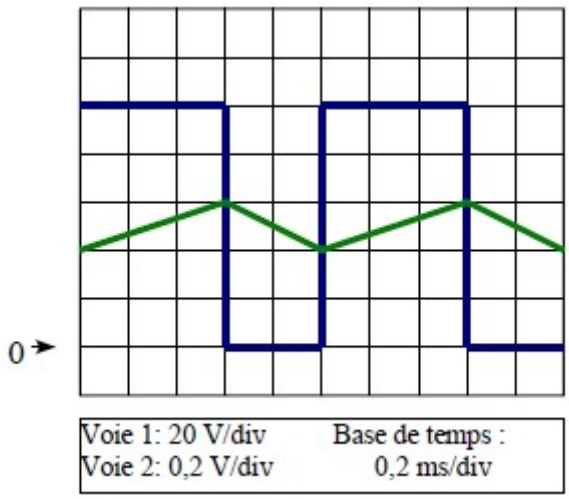
*L3AUTO*

Corrigé de l' Examen $AS512$
Électronique de Puissance

## Exercice 1 : (13 $pts$)




1. A partir de ce schéma :
   (a) La voie 1 : $u_c$ (1$pt$)
   (b) La voie 2 : $i$ (1$pt$)
2. L 'intérêt d'utiliser une résistance $r$ est de visualiser l'image du courant (1$pt$).




3. La fréquence de hachage :

$$f = \frac{1}{T} = \frac{1}{5 \times 0.2 \times 10^{-3}} = 1000Hz \quad (1pt)$$

4. Le rapport cyclique :

$$\alpha = \frac{\alpha T}{T} = \frac{3}{5} = 0.6 \quad (1pt)$$

5. La $f.e.m$ $E$

$$E = 5 \times 20 = 100V \quad (1pt)$$

6. La tension $U_{cmoy}$

$$U_{cmoy} = \alpha E = 0.6 \times 100 = 60V \quad (1pt)$$

7. Le courant $I_{moy}$

$$I_{moy} = \frac{I_{min} + I_{max}}{2}$$

$$rI_{min} = 2 \times 0.2 \Longrightarrow I_{min} = \frac{2 \times 0.2}{r} = \frac{2 \times 0.2}{1} = 0.4A$$

$$rI_{max} = 3 \times 0.2 \Longrightarrow I_{max} = \frac{3 \times 0.2}{r} = \frac{3 \times 0.2}{1} = 0.6A$$

$$I_{moy} = \frac{0.4 + 0.6}{2} = 0.5A \quad (1pt)$$

8. L 'expression de $U_{cmoy}$ en fonction de $R, I_{moy}$ et $E'$

$$u_c = L\frac{di}{dt} + R \cdot i + E'$$

$$U_{cmoy} = L\frac{dI_{moy}}{dt} + R \cdot i + E'$$

$$L\frac{dI_{moy}}{dt} = 0$$

$\Longrightarrow U_{cmoy} = RI_{moy} + E' \quad (1pt)$

9. $R = 0 \Longrightarrow U_{cmoy} = E'$

   $E' = \alpha E \quad (0.5pt)$

   $E' = 0.6 \times 100 = 60V \quad (0.5pt)$

10. $E' = k \cdot n \Longrightarrow k = \frac{E'}{n}$

$$k = \frac{60}{1200} = 0.05 \quad (1pt)$$

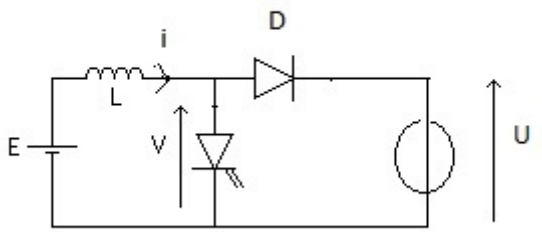
11. $n = 1600tr/min$

    $E' = 0.05 \times 1600 = 80V \quad (1pt)$

12.

$$\alpha = \frac{E'}{E} = \frac{80}{100} = 0.8 \quad (1pt)$$

## Exercice 2 : $(7pts)$



1. $V_{moy} = (1-\alpha)U = 0.6 \times 250 = 150V \quad (1pt)$

2. $E - L\frac{di}{dt} - v = 0 \Longrightarrow v = E - L\frac{di}{dt}$

$$V_{moy} = E - L\frac{dI_{moy}}{dt}$$
$$L\frac{dI_{moy}}{dt} = 0$$
$$\Longrightarrow E = V_{moy} = 150V \quad (1pt)$$

3. $0 < t < \alpha T$

$$E - L\frac{di}{dt} = 0 \Longrightarrow \frac{di}{dt} = \frac{E}{L}$$
$$di = \frac{E}{L}dt \Longrightarrow i(t) = \frac{Et}{L} + C$$

à $t = 0; i(0) = I_{min}$

$I_{min} = C$

$$i(t) = \frac{Et}{L} + I_{min} \quad (1pt)$$

4. $\alpha T < t < T$

$$E - L\frac{di}{dt} - u_D - U = 0 \Longrightarrow \frac{di}{dt} = \frac{E-U}{L}$$
$$di = \frac{E-U}{L}dt \Longrightarrow i(t) = \frac{(E-U)t}{L} + C'$$

à $t = \alpha T; i(\alpha T) = I_{max}$

$I_{max} = \frac{(E-U)\alpha T}{L} + C' \Longrightarrow C' = I_{max} - \frac{(E-U)\alpha T}{L}$

$$i(t) = \frac{(E-U)(t-\alpha T)}{L} + I_{max} \quad (1pt)$$

5. $t = T; i(T) = I_{min}$

$$I_{min} = \frac{(E-U)(T-\alpha T)}{L} + I_{max}$$
$$\Longrightarrow \Delta I = \frac{(U-E)(T-\alpha T)}{L} \quad (1pt)$$

6. $I_{min} = 10A$ et $I_{max} = 12A$.

$P_e = V_{moy} \cdot I_{moy}$

$$I_{moy} = \frac{I_{max} + I_{min}}{2} = \frac{10+12}{2} = 11A$$

$$P_e = 150 \times 11 = 1650W \quad (1pt)$$

$$P_s = U \cdot I_{moy} = 250 \times 11 = 2750W \quad (1pt)$$