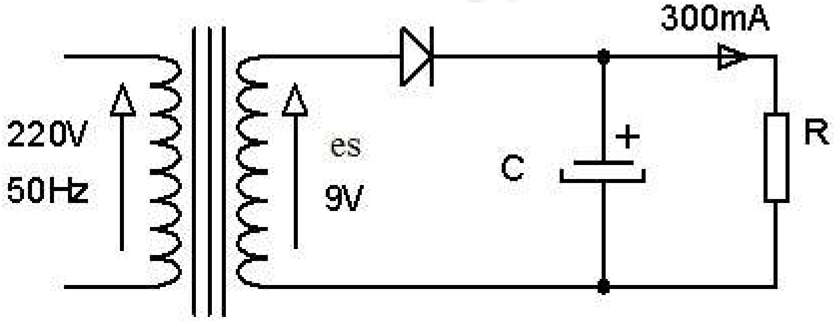
Redressement et filtrage

Exercice 1



Indice de ronflement : $\eta = 0{,}1$ Tension directe de la diode : $V_D = 0{,}6V$

1. $es = E \sin(\omega t + \varphi)$ $E = 9V\sqrt{2} = 12{,}73V$ $\varphi = 0°$ $\omega = 2\pi f = 100\pi$

$\mathbf{es = 9V\sqrt{2}\sin(100\pi t)}$

2. $U_{Rmax} = E - V_D = 9V\sqrt{2} - 0{,}6V$ $\mathbf{U_{Rmax} = 12{,}13V}$

3. $\eta = \Delta V / U_{Rmax} = 0{,}1$ $\Rightarrow$ $\Delta V = 0{,}1 \text{ x } 12{,}13V$ $\mathbf{\Delta V = 1{,}2V}$

4. $U_{Rmoyen} = U_{Rmax} - \Delta V/2 = 12{,}13V - 0{,}6V$ $\mathbf{U_{Rmoyen} = 11{,}53V}$

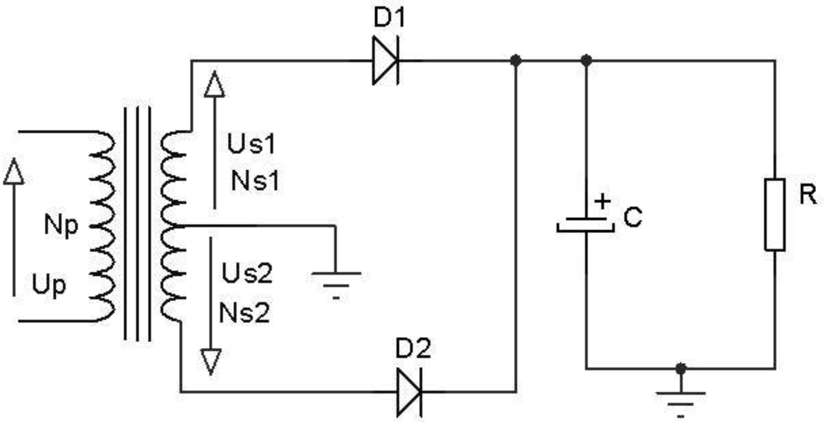
5.

$$C = \frac{I_{Rmoy} T}{\Delta V} = \frac{I_{Rmoy}}{f \Delta V} = \frac{300mA}{50Hz \text{ x } 1{,}2V} = \frac{0{,}3A}{50Hz \text{ x } 1{,}2V}$$

$\mathbf{C = 5000\mu F}$

6. $R = U_{Rmoy} / I_{Rmoy} = 11{,}53V / 0{,}3A$ $\mathbf{R = 38{,}43\Omega}$

Exercice 2



Transformateur : 220V/ 2 x12V 50Hz.

Le nombre de spires du primaire : $N_P = 440$.

La charge résistive R = 100 Ω.

La tension directe de chaque diode est : $V_D = 0{,}6V$.

Taux d'ondulation de la tension de 10 %.

1. nombre de spires des enroulements du secondaire

$U_{S1} = U_{S2} \quad \Rightarrow \quad N_{S1}/N_P = N_{S2}/N_P = U_{S1}/U_P = U_{S2}/U_P$

$N_{S1} = N_{S2} = N_P \times U_{S1}/U_P = 440 \times 12V / 220V$ **$N_{S1} = N_{S2} = 24$**

2. $U_{Rmax} = U_{S1max} - V_D = 12V\sqrt{2} - 0{,}6V$ **$U_{Rmax} = 16{,}4V$**

3. $\Delta V = \eta \times U_{Rmax} = 0{,}1 \times (12V\sqrt{2} - 0{,}6V)$ **$\Delta V = 1{,}64V$**

4. $U_{Rmoy} = U_{Rmax} - \Delta V/2 = 16{,}4V - 0{,}82V$ **$U_{Rmoy} = 15{,}58V$**

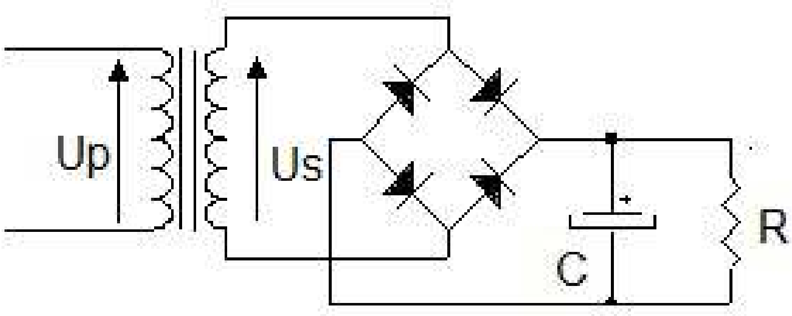
5. F = 50 Hz et $I_{Rmoy} = U_{Rmoy} / R$

$$C = \frac{I_{Rmoy}}{f\Delta V} = \frac{U_{Rmoy}}{f\Delta VR} = \frac{15{,}58V}{2 \times 50Hz \times 1{,}64V \times 100\Omega}$$

$C = 950\mu F$

En pratique, on prend un condensateur de 1000µF.

Exercice 3



$U_P = 220V$ $f = 50Hz$ $R = 100\Omega$ $N_S/N_P = 1/10$ $V_D = 0,6V$ $\Delta V = 0,5V$

1.

$$U_{Rmax} = U_S\sqrt{2} - 2V_D = \frac{N_S}{N_P} U_P\sqrt{2} - 2 \times V_D = \frac{220V\sqrt{2}}{10} - 2 \times 0,6V$$

$\boxed{U_{Rmax} = 29,91V}$

2. $U_{Rmoy} = U_{Rmax} - \Delta V/ 2 = 29,91V – 0,25V$ $\boxed{U_{Rmoy} = 29,66V}$

$I_{Rmoy} = U_{Rmoy} / R = 29,66V / 100\Omega$ $\boxed{I_{Rmoy} = 296,6mA}$

3. fr : fréquence du signal redressé aux bornes de la charge

$f = 50Hz$ $fr = 2 \times f = 2 \times 50Hz$ $\boxed{fr = 100Hz}$

4. $C = I_{Rmoy} / (\Delta V \times fr) = 296,6mA / (0,5V \times 100Hz)$ $\boxed{C = 5932\mu F}$

5. $U_{Rmax} - U_{Rmin} = \Delta V \Rightarrow U_{Rmin} = 29,91V - 0,5V$ $\boxed{U_{Rmin} = 29,41V}$

6. $\eta = \Delta V/ U_{Rmax} = 0,5V / 29,91V$ $\boxed{\eta = 0,0167}$

7. $\Delta V = I_{Rmoy} / (C \times fr) = U_{Rmoy} / (R \times C \times fr) = 28,6V / (100\Omega \times 2200\mu F \times 100Hz)$

$\Delta V = 28,6V / 22$ $\boxed{\Delta V = 1,3V}$