Facultad de Ingeniería. UNAM. Electrónica Básica

Cálculo del capacitor de filtro de rizado.

1.-Calcule, con el modelo ideal del diodo, el Capacitor C1 de la figura 1 con los siguientes datos:

a) Vrms =48[V] RL = 22[Ω] f =60[Hz] Vmin =40[V]

b) Vrms =18[V] RL = 18[Ω] f =60[Hz] Vmin =20[V]

c) Vrms =14[V] RL = 7[Ω] f =38,000[Hz] Vmin =18 [V]

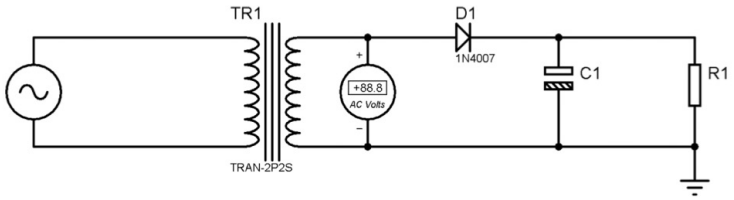

Figura 1-. Rectificador de media onda

a) $V_{min} = V_m Sen(\omega t) \quad \omega = 2\pi f \quad V_m = V_{rms}\sqrt{2}$

$$t = \frac{sen^{-1}\left(\frac{V_{min}}{V_m}\right)}{2\pi f} = \frac{sen^{-1}\left(\frac{40}{48\sqrt{2}}\right)}{2\pi(60)} = 1.6715 \text{ [ms]}$$

$$t_d = \frac{3}{4f} + t = \frac{3}{4(60)} + 1.6715 \text{ [ms]} = 14.1715 \text{ [ms]}$$

$$C_1 = \frac{-t_d}{R_L \ln\left(\frac{V_{min}}{V_m}\right)} = \frac{-14.1715 \times 10^{-3}}{22 \ln\left(\frac{40}{48\sqrt{2}}\right)} = 1.2179 \text{ [nf]}$$

b)

$$t = \frac{sen^{-1}\left(\frac{V_{min}}{V_m}\right)}{2\pi f} = \frac{sen^{-1}\left(\frac{20}{18\sqrt{2}}\right)}{2\pi(60)} = 2.3974 \text{ [ms]}$$

$$t_d = \frac{3}{4f} + t = \frac{3}{4(60)} + 2.3974 \text{ [ms]} = 14.8974 \text{ [ms]}$$

$$C_1 = \frac{-t_d}{R_L \ln\left(\frac{V_{min}}{V_m}\right)} = \frac{-14.8974 \times 10^{-3}}{18 \ln\left(\frac{20}{18\sqrt{2}}\right)} = 3.4311 \text{ [nf]}$$

c)

$$t = \frac{\text{sen}^{-1}\left(\frac{V_{min}}{V_m}\right)}{2\pi f} = \frac{\text{sen}^{-1}\left(\frac{18}{14\sqrt{2}}\right)}{2\pi(38000)} = 4.7797[\mu S]$$

$$td = \frac{3}{4f} + t = \frac{3}{4(38000)} + 4.7797\times10^{-6} = 24.5165[\mu S]$$

$$C_1 = \frac{-td}{R_L \ln\left(\frac{V_{min}}{V_m}\right)} = \frac{-(24.5165\times10^{-6})}{7\ln\left(\frac{18}{1\sqrt{2}}\right)} = 36.7667[\mu F]$$

2.-Calcule, con el modelo ideal del diodo, el Capacitor C2 de la figura 2 con los siguientes datos:

d) Vrms = 9[V] RL = 35[Ω] f =60[Hz] Vmin =11[V]

e) Vrms = 36[V] RL = 20[Ω] f =60[Hz] Vmin =46[V]

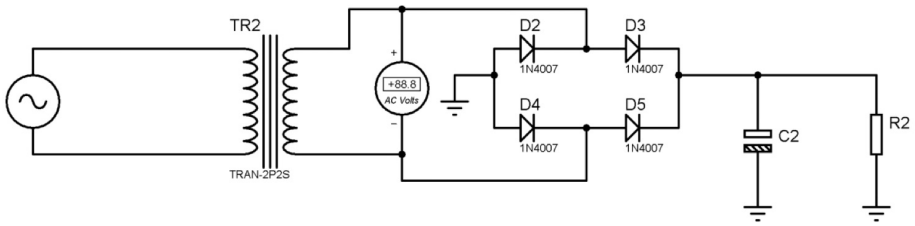

Figura 2-. Rectificador de onda completa.

d) $V_m = V_{RMS}\sqrt{2}$ $\quad W = 2\pi f$ $\quad V_{min} = V_M \text{Sen}(Wt)$

$$t = \frac{\text{sen}^{-1}\left(\frac{V_{min}}{V_m}\right)}{2\pi f} = \frac{\text{sen}^{-1}\left(\frac{11}{9\sqrt{2}}\right)}{2\pi(60)} = 2.7683(ms)$$

$$td = \frac{1}{4f} + t = \frac{1}{4(60)} + 2.7683\times10^{-3} = 6.9350[ms]$$

$$C_2 = \frac{-td}{R_L \ln\left(\frac{V_m}{V_{min}}\right)} = \frac{-6.9350\times10^{-3}}{35\ln\left(\frac{11}{9\sqrt{2}}\right)} = 1.3580[\mu F]$$

e)

$$t = \frac{\text{sen}^{-1}\left(\frac{V_{min}}{V_m}\right)}{2\pi f} = \frac{\text{sen}^{-1}\left(\frac{46}{36\sqrt{2}}\right)}{2\pi(60)} = 2.9919[ms]$$

$$td = \frac{1}{4f} + t = \frac{1}{4(60)} + 2.9929\times10^{-3} = 7.1586[ms]$$

$$C_2 = \frac{-td}{R_L \ln\left(\frac{V_m}{V_{min}}\right)} = \frac{-(7.1586\times10^{-3})}{20\ln\left(\frac{46}{36\sqrt{2}}\right)} = 3.5281[mF]$$