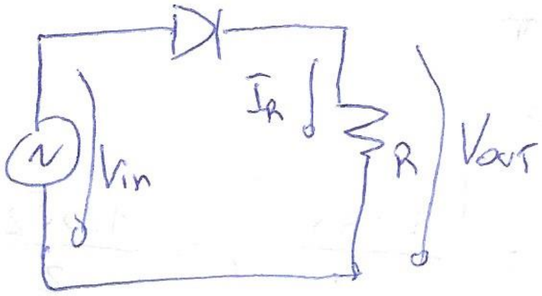


$$V_{in} = V_{MAX}\ sen(\theta)$$

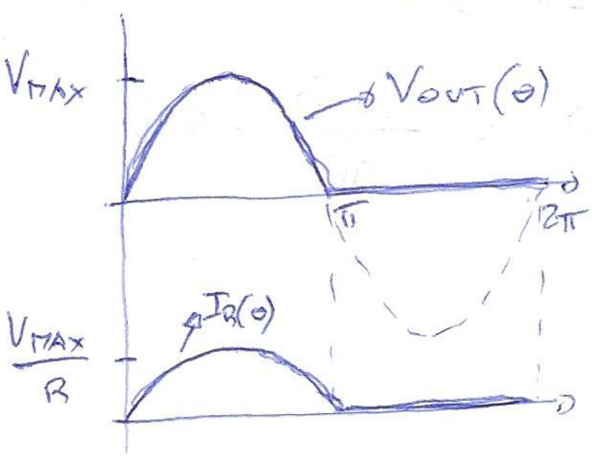
$$V_{MAX} = 120\sqrt{2}\ V$$

$$V_{in_{RMS}} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi}(V_{MAX}\ sen\ \theta)^2\, d\theta} = \frac{V_{MAX}}{\sqrt{2\pi}}\sqrt{\int_0^{2\pi} sen^2\theta\, d\theta}$$

$$= \frac{V_{MAX}}{\sqrt{2\pi}}\sqrt{\int_0^{2\pi}\frac{1-\cos(2\theta)}{2}\cdot d\theta} = \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}}\sqrt{\left[\int_0^{2\pi}1.\,d\theta - \int_0^{2\pi}\cos(2\theta)\,d\theta\right]}$$

$$= \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}}\sqrt{\left[[\theta]_0^{2\pi} - \frac{1}{2}\int_0^{2\pi}2\times\cos(2\theta)\,d\theta\right]} = \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}}\sqrt{\left[2\pi - \frac{1}{2}\times\underbrace{[sen(2\theta)]_0^{2\pi}}_{0}\right]}$$

$$= \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}}\times\sqrt{2\pi} = \boxed{\frac{V_{MAX}}{\sqrt{2}}} = \frac{120\sqrt{2}}{\sqrt{2}} = 120\ V$$



$$V_{OUT_{RMS}} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} V_{OUT}(\theta)^2} = \sqrt{\frac{1}{2\pi}\int_0^{\pi}\left[V_{MAX}\,sen(\theta)\right]^2}$$

$$= \frac{V_{MAX}}{\sqrt{2\pi}} \times \sqrt{\int_0^{\pi} \frac{1-\cos(2\theta)}{2}\,d\theta} = \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}} \times \sqrt{\left[\int_0^{\pi} 1\,d\theta - \int_0^{\pi}\cos(2\theta)\,d\theta\right]}$$

$$= \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}} \times \sqrt{\left[\theta\right]_0^{\pi} - \frac{1}{2}\left[sen(2\theta)\right]_0^{\pi}}$$

$$= \frac{V_{MAX}}{\sqrt{2}\sqrt{2\pi}} \times \sqrt{(\pi - 0) - \frac{1}{2}(0-0)} = \boxed{\frac{V_{MAX}}{2}} = \frac{120\sqrt{2}}{2}$$

$$= 84{,}8\ V$$

$$I_{R_{RMS}} = \frac{I_{R_{MAX}}}{2} = \frac{\frac{V_{MAX}}{R}}{2} = \frac{120\sqrt{2}}{2 \times 300} = 0{,}282\ A$$

$$V_{OUT_{medio}} = \frac{1}{2\pi}\int_0^{2\pi} V_{OUT}(\theta)\,d\theta = \frac{1}{2\pi}\int_0^{\pi} V_{MAX}\,sen(\theta)\,d\theta$$

$$= \frac{V_{MAX}}{2\pi}\left[-\cos(\theta)\right]_0^{\pi} = -\frac{V_{MAX}}{2\pi}\left[\cos(\pi) - \cos(0)\right]$$

$$= -\frac{V_{MAX}}{2\pi}\left[-1-1\right] = \boxed{\frac{V_{MAX}}{\pi}} = \frac{120\sqrt{2}}{\pi} = 54V$$

$$I_{R_{medio}} = \frac{1}{2\pi}\int_0^{2\pi} I_R(\theta)\,d\theta = \frac{1}{2\pi}\int_0^{\pi} \frac{V_{MAX}}{R}\,sen(\theta)\,d\theta$$

$$= \frac{\frac{V_{MAX}}{R}}{\pi} = \frac{120\sqrt{2}}{300\pi} = 0{,}180\ A$$

$$P_{FONTE} = \frac{1}{2\pi}\int_0^{2\pi} Vin(\theta) \times I_R(\theta)\,d\theta = \frac{1}{2\pi}\int_0^{\pi} V_{MAX}\,sen\theta \times \frac{V_{MAX}}{R}\,sen\,\theta\,d\theta$$

$$= \frac{V_{MAX}^2}{2\pi R}\int_0^{\pi} sen^2\theta\,d\theta = \frac{V_{MAX}^2}{2\pi R}\int_0^{\pi}\frac{1-\cos(2\theta)}{2}\,d\theta$$

$$= \frac{V_{MAX}^2}{4\pi R}\left[\int_0^{\pi} 1\,d\theta - \int_0^{\pi}\cos(2\theta)\,d\theta\right]$$

$$= \frac{V_{MAX}^2}{4\pi R}\left[\left[\theta\right]_0^{\pi} - \frac{1}{2}\underbrace{\left[sen(2\theta)\right]_0^{\pi}}_{0}\right]$$

$$= \boxed{\frac{V_{MAX}^2}{4R}} = 24\ W$$

Em alternativa, para cargas RLE

$$P_{FONTE} = R \times I_{R_{RMS}}^2 + E \times I_{R_{medio}} = 300 \times 0{,}282^2 \simeq 24\ W$$

$$S_{FONTE} = Vin_{RMS} \times I_{IN_{RMS}} = 120 \times 0{,}282 = 33{,}8\ VA$$

$$FP_{FONTE} = \frac{P_{FONTE}}{S_{FONTE}} = \frac{24}{33{,}8} = 0{,}71$$

Ponto 15)

	1		2		3	
	F (Hz)	Amp (A)	F	Amp	F	Amp
I_R	50	0,281	100	0,12	200	0,024

$$THD = \frac{\sqrt{\sum_{i=2}^{\infty} I_n^2}}{I_1}$$ I_1, I_n valores eficazes

$$= \frac{\sqrt{\left(\frac{0,12}{\sqrt{2}}\right)^2 + \left(\frac{0,024}{\sqrt{2}}\right)^2}}{\frac{0,281}{\sqrt{2}}} = 0,435$$

THD medido em 13) igual a 0,437

Ponto 16)

A ondulação de V_{OUT} e respetivo valor médio pode ser calculado de forma aproximada por:

$$V_{OUT_{ripple}} \simeq V_{OUT_{MAX}} \times \frac{T}{RC}$$

$$V_{OUT_{medio}} \simeq V_{OUT_{MAX}} - \frac{V_{OUT_{ripple}}}{2}$$