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1) An air conditioner connected to a 120 V rms ac line is equivalent to a 12 Ω resistance and a 1,30 Ω inductive reactancance in series. calculate a) impedence of the air condtioner and b) The avarage rate which energy is supplied to the appliance.

Jawab :

a)

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{12^2 + (1{,}3 - 0)^2}$$

$$= \sqrt{144 + 1{,}69}$$

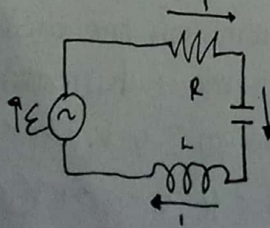
$$= 12{,}07 \ \Omega$$

b) $P_{rata} = I_{rms}^2 R = \left[\frac{\mathcal{E}_{rms}}{Z}\right]^2 R$

$$P_{rata} = \left(\frac{120}{12{,}07}\right)^2 \cdot 12$$

$$= 1{,}186 \times 10^3 W$$

2) In Fig. 31-7, R = 15,0 Ω, C = 4,7 μF dan L = 25,0 mH. The generator provides an emf with rms voltage 75,0 V and frequeny 550 Hz. a) what is the rms current ? what is the rms voltage across b) R, c) C, d) L e) C dan L together and F) R, C dan L together ? At what average rate is energy dissipated by (g) R, h) C and (i) L ?



a) rms current

$$I_{rms} = \frac{\mathcal{E}_{rms}}{Z} = \frac{\mathcal{E}_{rms}}{\sqrt{R^2 + (2\pi f L - 1/2\pi f C)^2}}$$

$$= \frac{75}{\sqrt{15^2 + (2\pi(550)(25 mH) - 1/2\pi(550)(4{,}7\mu F))^2}}$$

$$= 2{,}59 \ A$$

b) $V_{ab} = I_{rms} R$

$$= 2{,}59 \times 15$$

$$= 38{,}8 \ V$$

c) $V_{bc} = I_{rms} X_C = \frac{I_{rms}}{2\pi f C}$

$$= \frac{2{,}59}{2\pi \times 550 \times 4{,}7 \times 10^{-6}}$$

$$\approx 159 \ V$$

d) $V_{cd} = I_{rms} X_L$

$$= I_{rms} \times 2\pi f L$$

$$= 2{,}59 \times 2\pi \times 550 \times 25 \cdot 10^{-3}$$

$$\approx 224 \ V$$

e) $V_{bd} = |V_{bc} - V_{cd}|$

$$= |159{,}5 - 223{,}7| = 64{,}2 \ V$$

g) $P_R = \frac{V_{ab}^2}{R} = \frac{(38{,}8)^2}{15}$

$$\approx 100 \ W$$

h) $P_C = 0$

i) $P_L = 0$

3) In a series oscilating RLC circuit, R = 16,0 Ω, C = 31,2 μF, L = 9,2 mH, and $\mathcal{E}_m = \mathcal{E}_m \sin \omega_d t$ with $\mathcal{E}_m$ = 45,0 V. and ω_d = 3000 rad/s. For time t = 0,442 ms find a) the rate P_g at which energy is being supplied by the generator, b) the rate P_C at which the energy in the capacitor is changing, c) the rate P_L at which the energy in the inductor is changing, and d) the rate P_R at which energy is being dissipated in the resistor. e) is the sum of P_C, P_L, and P_R greater than, less than or equal to P_g ?

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Jawab)

$$I = \frac{\mathcal{E}_m}{Z} = \frac{\mathcal{E}_m}{\sqrt{R^2 + (\omega_d L - \omega_d C)^2}}$$

$$I = \frac{45}{\sqrt{16^2 + \left(3000 \times 9{,}20 \times 10^{-3} - \frac{1}{3000 \times 31{,}2 \times 10^{-6}}\right)^2}}$$

$\approx 1{,}93$ A

$$i(t) = I \sin(\omega_d t - \phi)$$

$$\phi = \tan^{-1}\left[\frac{X_L - X_C}{R}\right] = \tan^{-1}\left[\frac{\omega_d L - 1/\omega_d C}{R}\right]$$

$$= \tan^{-1}\left[\frac{(3000)(9{,}2 \cdot 10^{-3})}{16} - \frac{1}{(3000 \times 16 \times 31{,}2 \times 10^{-6}}\right]$$

$$= 46{,}5^\circ$$

a) $P_g = i(t)\mathcal{E}(t) = I\sin(\omega_d t - \phi)\,\mathcal{E}_m \sin \omega_d t$

$= 1{,}93 \times 45 \sin(3000 \times 0{,}442) \sin(3000 \times 0{,}442 - 46{,}5)$

$\approx 41{,}4$ W

b) $V_C = V_C \sin(\omega_d t - \phi - \pi/2) = -V_C \cos(\omega_d t - \phi)$

Ketika $V_C - I/\omega_d C$

$$P_C = \frac{d}{dt}\left[\frac{q^2}{2C}\right] = I\frac{q}{C} = IV_C$$

$$= -I\sin(\omega_d t - \phi)\left(\frac{I}{\omega_d C}\right)\cos(\omega_d t - \phi)$$

$$= -\frac{I^2}{2\omega_d C}\sin(2(\omega_d t - \phi))$$

$$- \frac{(1{,}93)^2}{2 \times 3000 \times 31{,}2 \times 10^{-6}} \sin(2(3000 \times 0{,}442) - 2(46{,}5))$$

$\approx -17{,}0$ W

c) $P_L - \frac{d}{dt}\left(\frac{1}{2}Li^2\right) = Li\frac{di}{dt}$ $= LI\sin(\omega_d t - \phi)\frac{d}{dt}[I\sin(\omega_d t - \phi)]$ $= \frac{1}{2}\omega_d L I^2 \sin(2(\omega_d t - \phi))$

$P_L = \frac{1}{2}(3000 \times 1{,}93^2 \times 9{,}2 \times 10^{-3} \sin(2(3000 \times 0{,}442) - 46{,}5))$

$\approx 44{,}1$ W

d) $P_R = I^2 R$

$= I^2 R \sin^2(\omega_d t - \phi)$

$= 1{,}93^2 \times 16 \sin^2(3000 \times 0{,}442 - 46{,}5)$

$\approx 14{,}4$ W

e) $P_L + P_R + P_C = 44{,}1 - 17 + 14{,}4 = 41{,}5$ W

karena $P_g \approx 41{,}4$

maka mereka memiliki nilai yang sama

4) A generator supplies 100V to a transformer's primary coil, which has 50 turns. If the secondary coil has 500 turn, what is the secondary voltage?

Jawab =

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$V_s = \frac{N_s}{N_p} V_p = \frac{500 \cdot 100}{50} = 1000\text{V}$$

5) An ac generator provides emf to a reactive load in a remote factory over a two-cable transmission line. At the factory a step-down transformer reduces the voltage from its (rms) transmission value V_t to a much lower value that is safe and convenient for use in the factory. The transmission line resistance is 0,30 Ω/cable. and the power generator is 250 kW. If V_t = 80kV what are (a) the voltage decraese ΔV along the transmission line and b) the rate P_d at which energy is dissipated in the line as thermal energy? If V_t = 8,0kV what are c) ΔV and d) P_d? If V_t = 0,8kV what are e) ΔV and (f) P_d?

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a) $\Delta V = I_{rms} . R$

$= \frac{P}{V_t} . R$

$= \frac{250 \times 10^3}{80 \times 10^3} . 0{,}30 = 1{,}9 \text{ V}$

b) $P_d = I_{rms}^2 R = (3{,}125)^2 (0{,}30) = 5{,}9 \text{ W}$

c) $I_{rms} = \frac{250 \times 10^3}{8 \times 10^3}$

$= 31{,}25$

$\Delta V = (31{,}25)(0{,}60) = 19 \text{ V}$

d) $P_d = (3{,}125)^2 (0{,}60) = 5{,}9 \times 10^2 \text{ W}$

e) $I_{rms} = 250 \times 10^3 \left(\frac{1}{0{,}8 \times 10^3} \right) = 312{,}5 \text{ A}$

$\Delta V = (312{,}5)(0{,}60) = 1{,}9 \times 10^2 \text{ V}$

f) $P_d = (312{,}5)^2 (0{,}60) = 5{,}9 \times 10^4 \text{ W}$