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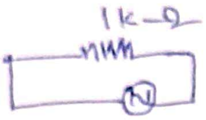
IT-A

BEE Assignment-2

1) A sinusoidal voltage is applied to the circuit as shown in figure



, Determine RMS current, average current, peak current and peak to peak current.

Sol:

$\because V_{rms} = \frac{V_P}{\sqrt{2}} \Rightarrow V_{RMS} = \frac{10}{\sqrt{2}} = \boxed{V_{RMS} = 7.071V}$

$I_{RMS} = \frac{V_{RMS}}{R} = \frac{7.071}{1000} = 7.071 \times 10^{-3} A$

$\Rightarrow \boxed{I_{RMS} = 7.071 mA}$

$I_{avg} = i_0 \times 0.637$

$i_0 = I_{RMS} \times \sqrt{2} \Rightarrow \boxed{i_0 = 9.999 mA}$

$I_{avg} = 9.999 \times 0.637$

$\boxed{I_{avg} = 6.369 mA}$

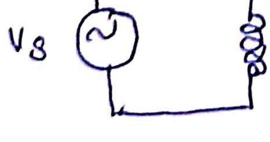
peak current, $I_P = ?$

$I_P = \frac{V_P}{R} \Rightarrow I_P = \frac{10}{1000} \Rightarrow \boxed{I_P = 10 mA}$

peak to peak current

$I_{P \cdot P} = 2 \times 10 mA = 20 mA$

2) Determine the rms current in the circuit



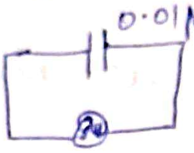
$V_{RMS} = 10V, \ f = 10kHz, \ L = 50mH$

$X_L = \omega L = 2\pi f L = 2\pi \times 10 \times 10^3 \times 50 \times 10^{-3}$

$\boxed{X_L = 3.14 k\Omega}$

$I_{Rms} = \frac{V_{Rms}}{X_L} \Rightarrow I_{Rms} = \frac{10}{3.14 \times 10^3} \Rightarrow \boxed{I_{Rms} = 3.18\, mA}$

3) Determine the rms current in the current



$V_{Rms} = 5V,\ f = 5kHz$

$C = 0.01 \mu F$

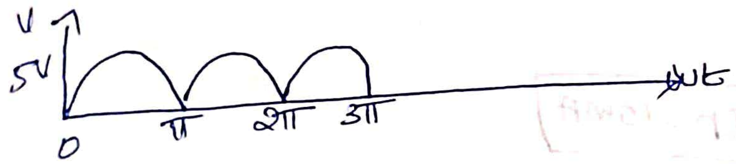
$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \frac{1}{2 \times 3.14 \times 5 \times 10^3 \times 0.01 \times 10^{-6}}$

~~3) Determine the rms current in the circuit~~

$\boxed{X_C = 3.18 k\Omega}$

$I_{Rms} = \frac{V_{rms}}{X_C} = \frac{5}{3.18 \times 10^3} = 1.57 mA$

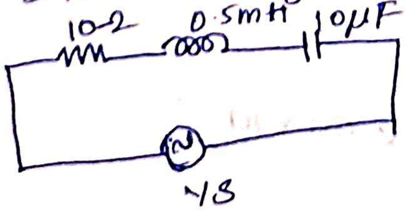
4) Find the average and rms values of wave rectified sine wave shown.



$\text{Avg value} = \frac{2 \times I_m}{\pi} = \frac{2 \times 5}{3.14} = \frac{10}{3.14} = 3.18$

$\text{rms value} = \sqrt{\frac{25}{2}} = \sqrt{12.5} = 3.535$

5) Determine the resonant frequency for the circuit shown in figure



Solu

$$fr = \frac{1}{2\pi\sqrt{LC}} \Rightarrow fn = \frac{1}{2\times3.14\sqrt{0.3\times10^{-3}\times10\times10^{-6}}}$$

$$= \frac{1}{2\times3.14\times2.23}$$

$$\boxed{fr = 2.25\ kHz}$$

b) A voltage of $v(t) = 100\sin\omega t$ is applied to a circuit. The current flowing through this circuit is $i(t) = 15\sin(\omega t - 30°)$

Sol

a) Determine the avg. power delivered to the circuit

$$\boxed{P_{avg} = VI\cos\phi}$$

$\phi = 30°$, $V_m = 100V$, $I_{am} = 15V$

$$V_{rms} = \frac{V_m}{\sqrt{2}} = 70.71V$$

$$I_{rms} = \frac{I_m}{\sqrt{2}} = 10.60A$$

$$\Rightarrow P_{avg} = 70.71\times10.60\times\cos(30°)$$

$$\boxed{P_{avg} = 649.5W}$$

b) Apparent power, $S = VI = 70.71\times10.60$

$$= 749.526\ VA$$

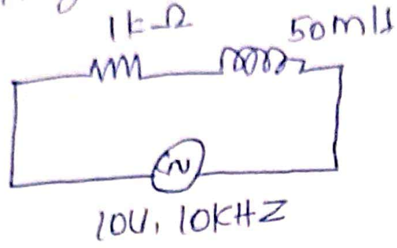
c) power factor $(\cos\phi) = \cos(30°) = 0.566$

d) Reactive power, $Q = VI\sin\phi$

$$= 70.71\times10.60\times\sin(30°)$$

$$Q = 374.763\ VAR$$

7) RL: Find Impedence (Z), current (I), phase angle (ϕ), voltage across resistor V_R, Voltage across inductor V_L.



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

$X_L = 2\pi f L = 2 \times 3.14 \times 10 \times 10^3 \times 50 \times 10^{-3} = 3.14 \Omega$

$\Rightarrow Z = \sqrt{(1000)^2 + (3.14)^2} = 3295.4 k\Omega$

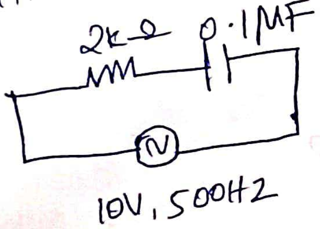
(ii) $I = \frac{V}{Z} = \frac{10}{3.295.4 \times 10^3} = 3.03 mA$

(iii) $\phi = \tan^{-1}\left(\frac{X_L}{R}\right) = \tan^{-1}\left(\frac{3.14}{1000}\right) = 72.33°$,

iv) $V_R = I \times R = 3.03 \times 10^{-3} \times 10^3 = 3.03V$

v) $X_L = I \times X_L = 3.03 \times 3.14 = 9.51 V$

8) RC: Determine total Impedence Z; current I, phase angle ϕ, capacitive voltage V_C, Resistive Vortage V_R.



Sol:-

$X_L = 1/\omega c = 1/2\pi f c = \frac{1}{2 \times 3.14 \times 500 \times 0.1 \times 10^{-2}} = 3180 k\Omega$

$Z = \sqrt{R^2 \times (X_C)^2}$ $= \cancel{3760.6k\Omega}$ $3760.6k\Omega$

$I = \frac{V}{Z} = 10/3760.6 = 2.66 mA$

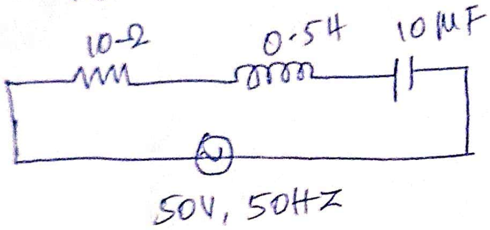
$\phi = \tan^{-1}\left(\frac{X_C}{R}\right) = \tan^{-1}\left(\frac{-3180 \times 10^3}{2000}\right) = -57.87°$

(ϕ),
$r\ V_L$.

$V_C = I(X_L) = 2.66\times10^{-3}\times 3180\times10^{3} = 8.47V$

$V_R = I(R) = 2.66\times10^{-3}\times 2\times10^{3} = 5.32V$

Q) RLC: Determine the total Z, I, ϕ, V_R, V_L, V_C



$X_L = \omega L = 2\pi f L = 2\times3.14\times50\times0.5 = 157\Omega$

$X_C = 1/\omega C = 1/2\pi f C = 1/2\times3.14\times10\times10^{-6}\times50 = 318.47\Omega$

$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{(10)^2 + (157 - 318.47)^2}$

$\boxed{Z = 161.8\Omega}$

$I = \frac{V}{Z} = \frac{50}{161.8} = 0.3A$

angle ϕ,

$\phi = \tan^{-1}\left(\frac{X_L - X_C}{R}\right) = \tan^{-1}\left(\frac{157 - 318.47}{10}\right) = 318.47\Omega$

$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{(10)^2 + (157 - 318.47)^2}$

$\boxed{Z = 161.8\Omega}$

$I = \frac{V}{Z} = \frac{50}{161.8} = 0.3A$

$\phi = \tan^{-1}\left(\frac{X_L - X_C}{R}\right) = \tan^{-1}\left(\frac{157 - 318.47}{10}\right) = -86.45°$

$V_L = I(X_L) = 0.3\times157 = 47.1V$

$V_R = I(R) = 0.3\times10 = 3V$

$V_L = I(X_C) = 0.3\times318.47 = 95.541V$.