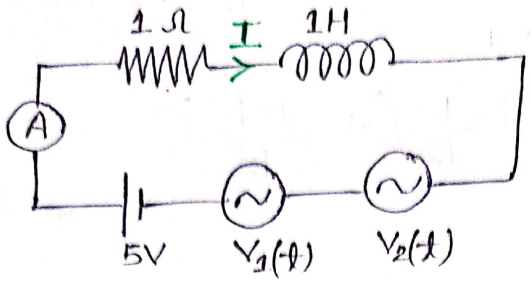
BE QUIZ-4 RUBRICS

SOL(1) :-



$V_1(t) = 10\sin(t)$

$V_2(t) = 10\sqrt{5}\sin(2t)$

NOTE: If nothing specified then RMS value considered of Ammeter in the question.

Here all sources having different frequencies, so by using Superposition theorem —

Case (I): According to 5V source

$X_L = \omega L = (0)(1) = 0$

$|Z| = \sqrt{1^2+0^2} = 1\ \Omega$

$I_0 = \frac{5}{|Z|} = \frac{5}{1} = 5A$ — (1 Point)

Case (II): According to $V_1(t) = 10\sin(t)$ source

$X_L = \omega L = (1)(1) = 1\ \Omega$

$|Z| = \sqrt{1^2+1^2} = \sqrt{2}\ \Omega$

$I_1 = \frac{(10/\sqrt{2})}{|Z|} = \frac{(10/\sqrt{2})}{\sqrt{2}} = 5A$ — (1 Point)

Case (III): According to $V_2(t) = 10\sqrt{5}\sin(2t)$ source

$X_L = \omega L = (2)(1) = 2\ \Omega$

$|Z| = \sqrt{1^2+2^2} = \sqrt{5}\ \Omega$

$I_2 = \frac{(10\sqrt{5}/\sqrt{2})}{|Z|} = \frac{(10\sqrt{5}/\sqrt{2})}{\sqrt{5}} = 5\sqrt{2}\ A$ — (1 Point)

$\therefore$ Ammeter reading, $I = \sqrt{I_0^2 + I_1^2 + I_2^2} = \sqrt{5^2+5^2+(5\sqrt{2})^2}$

$= 10A$ — (1 Point)

$$\text{Power Factor} = \cos\theta = \frac{P}{S} = \frac{\text{Active Power}}{\text{Apparent Power}} = \frac{I^2R}{VI} = \left(\frac{IR}{V}\right)$$

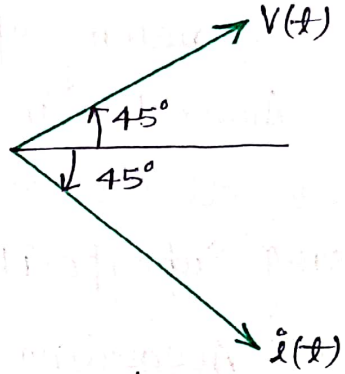
$$= \frac{10 \times 1}{\sqrt{5^2 + \left(\frac{10}{\sqrt{2}}\right)^2 + \left(\frac{10\sqrt{5}}{\sqrt{2}}\right)^2}} = \frac{10}{\sqrt{325}}$$

$$= 0.5$$ — (1 Point)

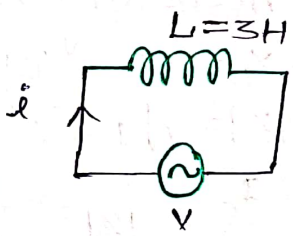
SOL(2):

(a) $v(t) = 9\sin(t + 45^\circ)$

$i(t) = 3\sin(t - 45^\circ)$



Here voltage phasor lead to current phasor by 90°. Hence circuit contain a pure inductor with source.



$X_L = \omega L$

$\frac{V}{i} = (1)(L)$

$\frac{(9/\sqrt{2})}{(3/\sqrt{2})} = (1)(L)$

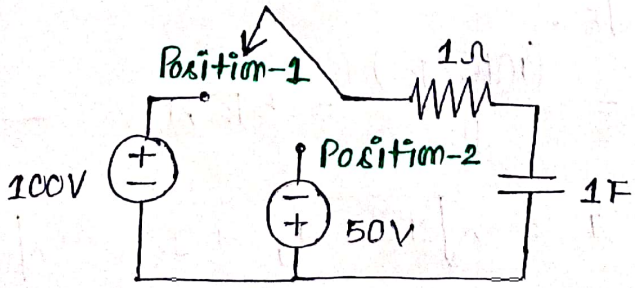
$\therefore L = 3H$ — (2 Point)

(b) $v(t) = 9\sin(t + 30^\circ)$

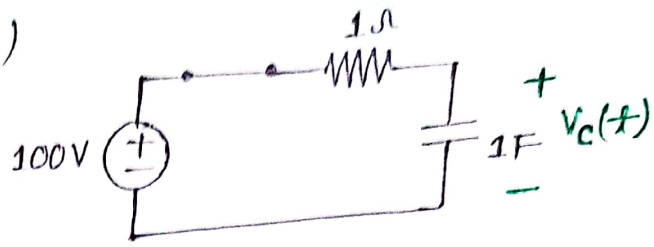
$i(t) = 3\sin(2t + 60^\circ)$

NOTE: By using above equation, it is not possible to decide the Network. Since frequency of voltage & current are unequal. — (2 Point)

SOL(3):



Case(I): at $t = 0$ sec (Position-1)



$$V_c(t) = V_0\left[1 - e^{-t/\tau}\right]$$

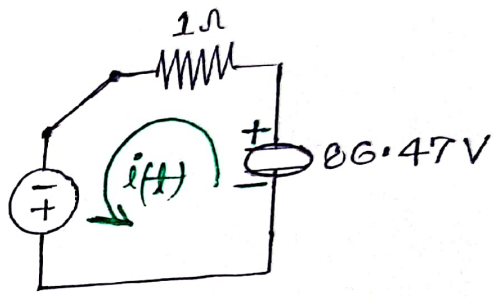
Here, $V_0 = 100$ Volt

$\tau = RC = (1)(1) = 1$ sec

$\therefore V_c(t) = 100\left[1 - e^{-t/1}\right] = 100\left(1 - e^{-t}\right)$ Volt

$\therefore V_c(2\tau) = V_c(2) = 100\left(1 - e^{-2}\right) = 86.47$ Volt — (2 Point)

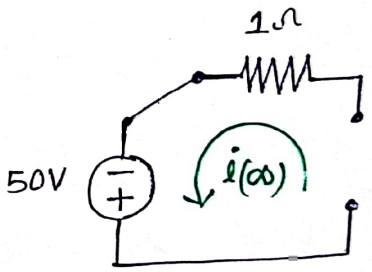
Case(II): at $t = 2\tau = 2$ sec (Position-2)



$$i(2) = \left(\frac{86.47 + 50}{1}\right) = 136.47\ A \quad \text{— (1)}$$

— (1 Point)

Case(III): at $t = \infty$ (Position-2)



$$i(\infty) = 0A \quad \text{— (2)}$$

— (1 Point)

Now current response in Position-2 (by using eqn(1) & eqn(2)) —

$$i(t) = \left[i(2) - i(\infty)\right]e^{-(t-2)/\tau} + i(\infty)$$

$$i(t) = \left[136.47 - 0\right]e^{-(t-2)/1} + 0$$

$$i(t) = (136.47)\,e^{-(t-2)}$$ — (2 Point)