Ch-1, 2 (2 Ques)
ch - 5 (1 Ques)
ch - 7 (1 Ques)
Ch-11, 13 (2/3 Ques)

Ch-17 (1 Ques) maybe

Chapter-1

Topic : 1.4, 1.5, 1.6, 1.8, 1.9, 1.10, 1.13, 1.15

1.19, 1.20

Varistor (definition)

Short and open circuit (feature)

Math : 1.3, 1.4, 1.5, 1.7, 1.8, 1.11, 1.12, 1.13, 1.18, 1.19

1.36, 1.37, 1.38, 1.39, 1.40

Chapter-2

Kirchhoff's law (KCL, KVL)

~~2.9~~ 2.14 : Source conversion (Voltage source, Current source)

2.15 : Ideal constant-Voltage Source
2.16 : " " -Current "
→ theory

2.17 : Superposition theorem.

Thevenin, Norton theorem.

Charging & Discharging of capacitor (theory)
and find time constant.

Capacitance (Definition)

Chapter - 7.

Topic : 7.3, 7.4.

Difference between Magnetic and electric circuit.

Math : 7.1, 7.2.

Chap - 11

Topic : 11.1, 11.2, 11.3, 11.8, 11.9, 11.11, 11.13, 11.15)
~~11.28~~

Definition : 11.18.

Math : 11.2, 11.3, 11.4, 11.38, 11.30, 11.40, 11.42,
11.43

Maximum power transfer (theorem and proof)

Power transfer efficiency (theorem, graph)

Math : 2.9, 2.10, 2.11, 2.12, 2.46, 2.47
2.60, 2.61, 2.62, 2.63, 2.96, 2.97,
2.98, 2.99, 2.115, 2.116, 2.117, 2.118

Chapter - ~~3~~ 4.

Topic : 4.2 (theory)
4.3 (coulomb's law)

Math : 4.1, 4.2, 4.3.

Chapter - 5.

Topic : 5.1, 5.2, 5.4, 5.12, 5.18,
5.19, 5.20

Math : 5.3, 5.4, 5.12, 5.13, 5.14, 5.15, 5.16,
5.38, 5.39.

Chapter - 12

Polar Vs rectangular form (conversion)

Chapter - 13

Definition → 13.2, 13.3, 13.4, 13.5

Topic : 13.7 (Not theory, just math)

*** 13.10

Math : 13.1, 13.2, 13.3, 13.4, 13.5, 13.32,

13.33, 13.34, 13.9, 13.43, 13.44, 13.45

Chapter-17

Topic : Types of Filter. (definitions)

Low pass filter (theory)

RC band pass filter.

Math : 17.4, 17.5.

5

$$\cos(C+D) = \cos C \cos D - \sin C \sin D$$
$$\sin(C-D) = \sin C \cos D - \cos C \sin D$$

a

$$i_1 = 4\cos(\omega t + 30^\circ)$$
$$i_2 = 5\sin(\omega t - 20^\circ)$$

$$I = i_1 + i_2$$

$$= 4\cos(\omega t + 30^\circ) + 5\sin(\omega t - 20^\circ)$$

$$= 4\left(\cos\omega t \cos 30^\circ - \sin\omega t \sin 30^\circ\right)$$
$$+ 5\left(\sin\omega t \cos 20^\circ - \sin 20^\circ \cos\omega t\right)$$

$$= 4\cos\omega t \cos 30^\circ - 4\sin 30^\circ \sin\omega t$$
$$+ 5\sin\omega t \cos 20^\circ - 5\sin 20^\circ \cos\omega t$$

$$= 2\sqrt{3}\cos\omega t - 2\sin\omega t + 4.698\sin\omega t$$
$$- 1.71\cos\omega t$$

$=$

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Apply KVL to mesh 1

$36 - 12I_1 - 24(I_1 - I_2) = 0$

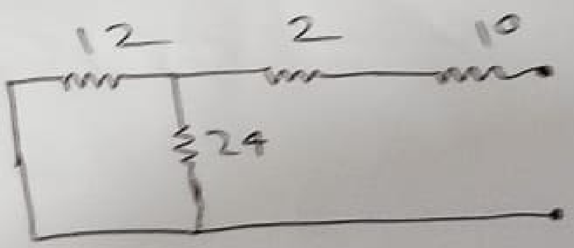
$\Rightarrow 36 - 36I_1 + 24I_2 = 0$

$\Rightarrow 36I_1 - 24I_2 = 36$ — (iii)

$I_1 = 2.8A$, $I_2 = 2.7A$, $I_3 = -0.3A$

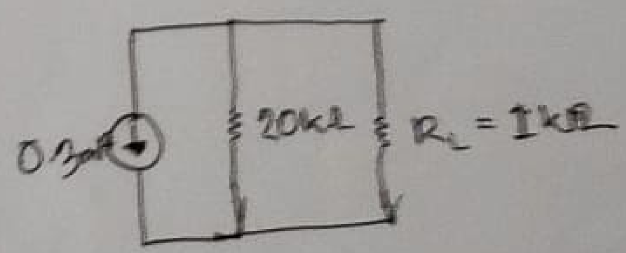
$I_N = -0.3A$

$\underline{R_N}$



$R_N = 20\Omega$

Circuit:



Mesh-3

$-4(i_3-i_2)-4I_0-12(i_3-i_1)=0$

$\Rightarrow -4i_3+4i_2-4I_0-12i_3+12i_1=0$

$\Rightarrow 12i_1+4i_2-16i_3-4I_0=0$

$-4(i_1-i_2)$

$\Rightarrow 8i_1+8i_2-16i_3=0$ — (iii)

$i_1 = 2.25$ A

$i_2 = 3/4 = 0.75$ A

$i_3 = 1.5$ A

$i_0 = 2.25 - 0.75 = 3/2 = 1.5$

b

KVL: It states that the sum of the voltages or electrical potential differences in a closed network is zero.

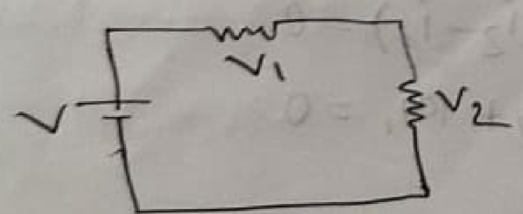
Mathematically we can express this as:

$$\sum_{n=1}^{m} V_n = 0$$

Where V_n represents the nth voltage.

M is the total number of voltage elements.

Example;



$V = 15$
$V_1 = 10$
$V_2 = 5$

according to KVL,

$V - V_1 - V_2 = 0 \Rightarrow 0 = 0$

$15 - 4(I_1 - I_2) - 10 - 8I_1 = 0$ $\qquad$ $4(I_1 - I_2) - 10 + 8I_1 + 15 = 0$

$\Rightarrow 15 - 4I_1 - 10 - 8I_1 = 0$ $\qquad$ $\Rightarrow -4I_1 + 8I_1 = 10 - 15$

$\Rightarrow$

$\Rightarrow 12I_1 = 5$

$\Rightarrow I_1 = 5/12$

$12I_1 - 4I_2 =$

$i_1 = 4\sin(\omega t + 120)$

$i_2 = 5\sin(\omega t - 20^\circ)$

$4(\sin\omega t \cos 120 + \cos\omega t \sin 120) + 5(\sin\omega t \cos 20 - \cos\omega t \sin 20)$

$= 4 \times -1/2 \sin\omega t + 4 \times \frac{\sqrt{3}}{2}\cos\omega t + 4.69\sin\omega t - 1.71\cos\omega t$

$= -2\sin\omega t + 2\sqrt{3}\cos\omega t + 4.69\sin\omega t - 1.71\cos\omega t$

$\Rightarrow (-2 + 4.69)\sin\omega t + (2\sqrt{3} - 1.71)\cos\omega t$ $\qquad$ $A\sin(\omega t + \varphi)$

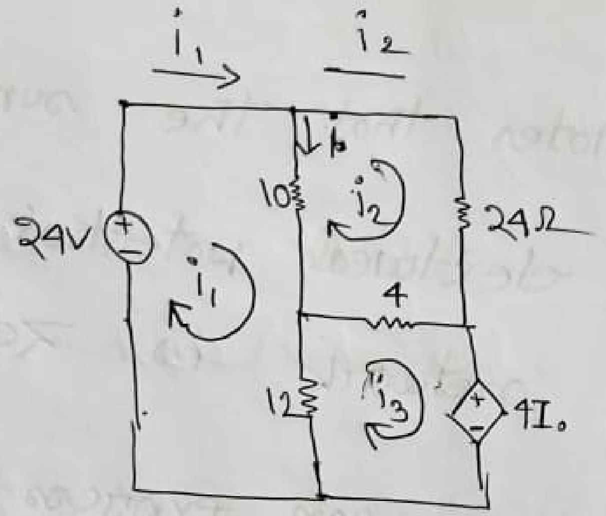
where

$\Rightarrow A\cos\varphi \sin\omega t + A\sin\varphi \cos\omega t$

$\frac{\sin\theta}{\cos\theta} = \tan\theta =$

$A^2(\sin^2\varphi + \cos^2\varphi) = (-2 + 4.69)^2 + (2\sqrt{3} - 1.71)^2$

e



$$i_1 - i_2 = i_0$$

Apply KVL to mesh-1:

$$24 - 10(i_1 - i_2) - 12(i_1 - i_3) = 0$$

$$\Rightarrow 10i_1 - 10i_2 + 12i_1 - 12i_3 = 24$$

$$\Rightarrow 22i_1 - 10i_2 - 12i_3 = 24 \quad \text{— (1)}$$

mesh-2

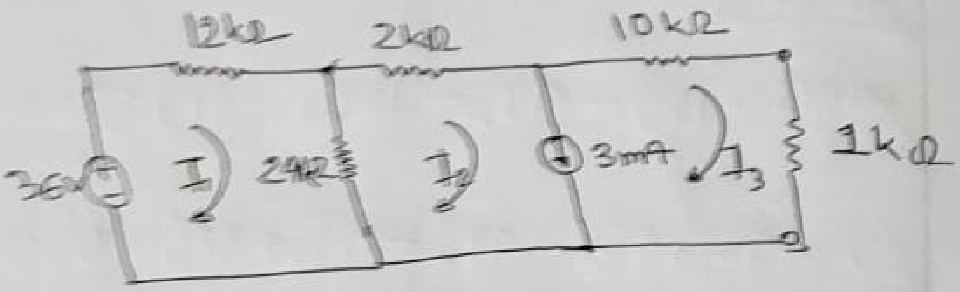
$$-24i_2 - 4(i_2 - i_3) - 10(i_2 - i_1) = 0$$

$$\Rightarrow -24i_2 - 4i_2 + 4i_3 - 10i_2 + 10i_1 = 0$$

$$\Rightarrow -38i_2 + 4i_3 + 10i_1 = 0$$

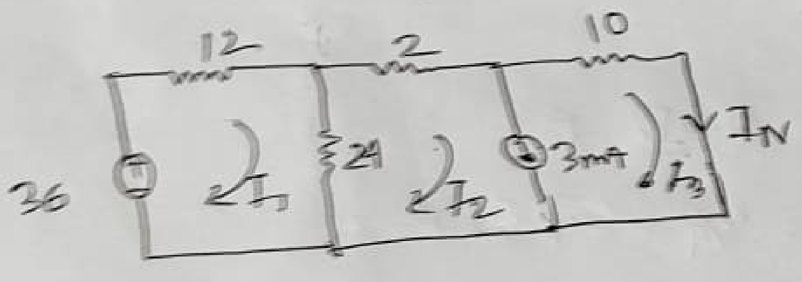
$$\Rightarrow \boxed{10i_1 - 38i_2 + 4i_3 = 0} \quad \text{— (ii)}$$

e



$\underline{I_N}$

Find the value of I_N .



$I_2 - I_3 = 3$ —— (i)

By observation

$-2I_2 - 10I_3 - 24(I_2 - I_1) = 0$

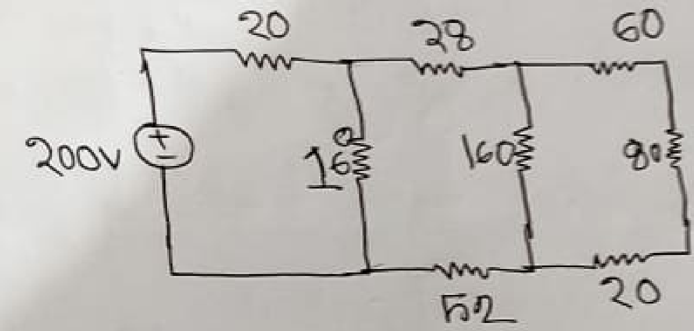
$\Rightarrow -2I_2 - 10I_3 - 24I_2 + 24I_1 = 0$

$\Rightarrow 24I_1 - 26I_2 - 10I_3 = 0$ —— (ii)

(9th Batch)

4

a



$$R_{eq} = \left(\left(\left(\underbrace{\left((60+80+20)^{-1} + 160^{-1}\right)^{-1}}_{80} + 28+52\right)^{-1} + 16^{-1}\right)^{-1} + 20$$

$$= 100\Omega$$

$$P = \frac{V^2}{R} = \frac{200^2}{100} = 400\,W \quad \underline{\underline{\text{Ans}}}$$

th

1. (c) 242

8th

1. (a) ~~(a)~~ page - 8 (1.7)
(b) Page - 29 (1.20)
(c)

2. (a) Page - 162 (2.30)
(b) 163 (1.115)
(c) page - 165 (2.31)

3. (a) page - 299 (7.3) Electro magnetic Induction is a current produced because of voltage production (electromotive force) due to a changing magnetic field. This either happens when a conductor is placed in a moving magnetic field (when using AC power source) or when a conductor is constantly moving in a stationary

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3.(b) page - 300 (7.2)

(c)

4. (a) page - 214 (5.2)

(b) page - 227 (5.16)

(c) page - 239 (5.18) P - 241 (5.19

5. (a) page - 216 (5.5)

(b) page - 219 (5.4)

(c) page - 274 (6.25)

(d) page - 260 (6.6)

7. (a)

(b) page - 540 (13.10)

8. (a) page - 99 (2.15) P - 100 (2.16)

(b) page - 100 (2.17)

(c) page - 101 (2.46)

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Voltage = 1V

Current, $I = \frac{1}{500} = 2\times10^{-3}A$

Ans

c

$$F = 9\times10^{9}\frac{q_1q_2}{d^2}$$

$$= 9\times10^{9}\times\frac{(3.2\times10^{-12})^2}{(10^{-13})^2}$$

$$= 9.216\times10^{12}\ N$$

Here

$q_1 = q_2 = 3.2\times10^{-12}C$

$d = 10^{-13}m$

$m_1 = m_2 = 6.68\times10^{-27}$

Nm^2/kg^2

The force of gravitational attraction between the two particles is given by

$$F_G = G\frac{m_1m_2}{d^2} = 6.67\times10^{-11}\times\frac{(6.68\times10^{-27})^2}{(10^{-13})^2}$$

$$= 2.97\times10^{-37}N$$

Obviously, the gravitational force is negligible as compared to the electrostatic force between the two particles.

4

a

Energy = power × time

$= 0.1\ kwh \times 2\ hours$

$= 0.2\ kwh$ or 0.2 Unit

Ans

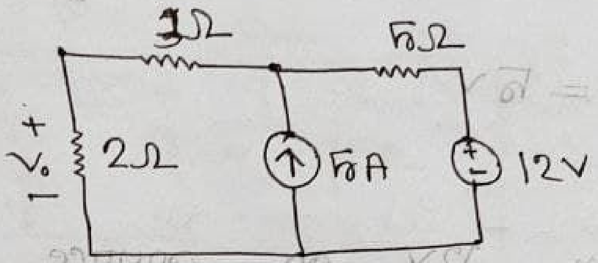
Given

Power = 100 watt

= 0.1 kilo watt

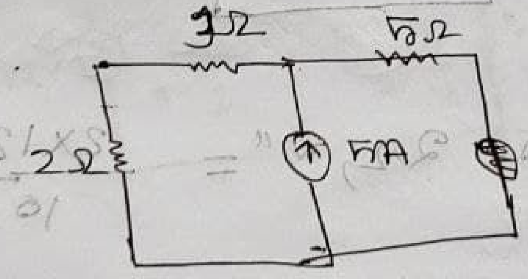
time = 2 hours

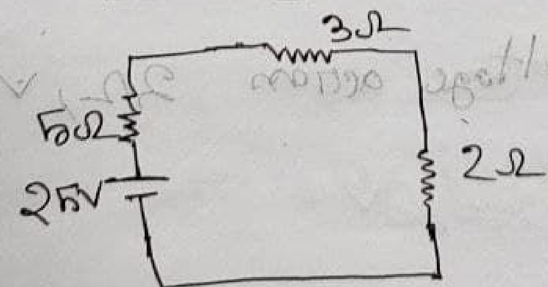
b



find the v_o using superposition theorem

Taking 5A source and replacing other sources with their internal resistance,

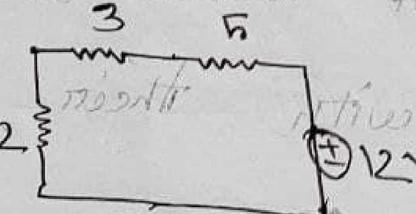




Voltage across $2\Omega = \frac{2 \times 25}{10} = 5V$

$v' = 5V$

Taking 12V as source and replace other sources with their internal resistance.



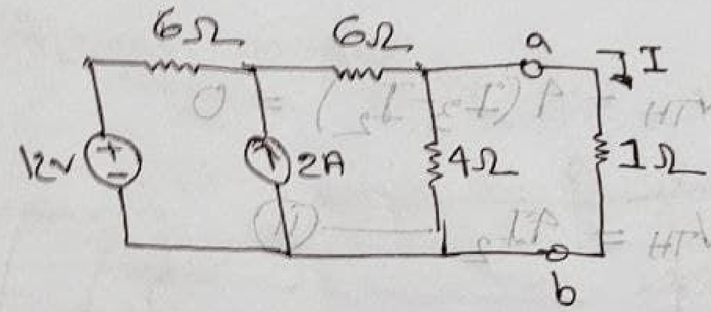
Voltage across 2Ω, $v'' = \frac{2 \times 12}{10} = 2.4V$

$\therefore$ total Voltage across 2Ω, $v = v' + v''$

$= (2.4 + 5)V$

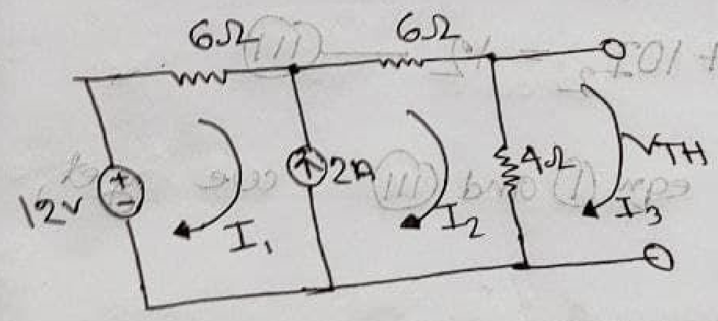
$= 7.4V$

Q



$R_L = 1\Omega$

Replace R_L with V_{th}



Here,

$$I_2 - I_1 = 2 \quad \text{—} \; (1)$$

(By observation)

Apply KVL to mesh-3,

$$-V_{TH} + 4(I_3 - I_2) = 0$$

$$\Rightarrow V_{TH} = 4I_2 \quad \text{—— (ii)}$$

Apply KVL to mesh-1 and mesh-2

$$12 - 6I_1 - 6I_2 - 4(I_2 - I_3) = 0$$

$$\Rightarrow 6I_1 + 10I_2 = 12 \quad \text{—— (iii)}$$

Solving eqn (i) and (iii) we get,

$$I_1 = 0.5A(\uparrow)$$

$$I_2 = 1.5A(\downarrow)$$

$$\therefore V_{TH} = (4 \times 1.5) = 6V$$

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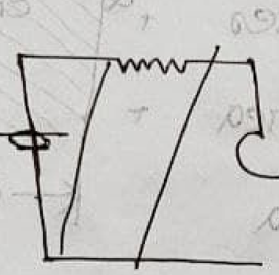
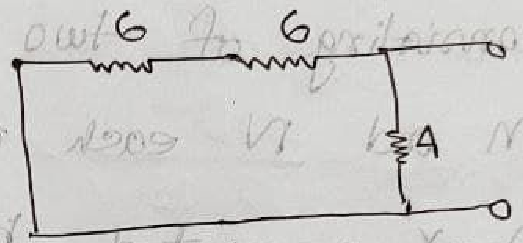
Remove R_L and Replace the sources with their internal sources.

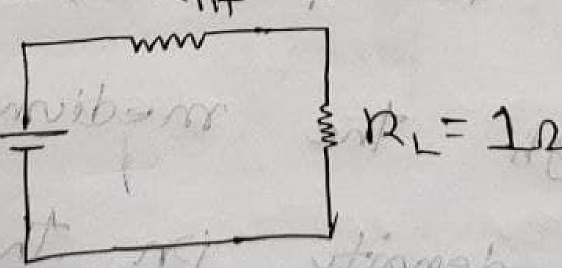




$$R_{TH} = \left\{(6+6)^{-1} + 4^{-1}\right\}^{-1}$$

$$= 3\,\Omega$$

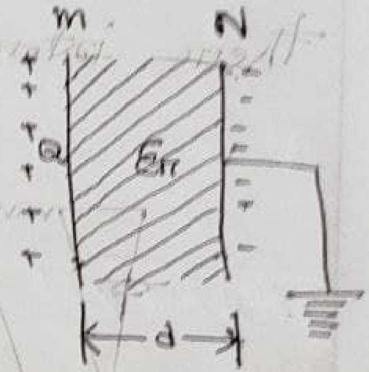
Circuit



$$I_{RL} = \frac{V_{TH}}{R_{TH} + R_L} = \frac{6}{3+1} = 1.5\,A$$

Q5

A parallel plate capacitor consisting of two plates M and N each of area A m^2 separated by a thickness d meters of a medium of relative permittivity ε_r is shown in the fig.



If a charge of +Q coulomb is given to plate M, then flux passing through the medium is $\Psi = Q$ coulomb.

Flux density in the medium is

$$D = \frac{\Psi}{A} = \frac{Q}{A}$$

Electric intensity $E = \frac{V}{d}$ and $D = \varepsilon E$

$\therefore \quad D = \varepsilon \cdot \frac{V}{d}$

$\Rightarrow \frac{Q}{A} = \varepsilon \frac{V}{d}$

$\Rightarrow \frac{Q}{V} = \varepsilon \frac{A}{d}$

$\Rightarrow C = \frac{\varepsilon_0 \varepsilon_r A}{d} = \frac{\varepsilon_0 A}{d}$

b

Given

$C = 4\times10^{-9}\ \mu F$

$V = 2\times10^{9}\ V$

$A = 200\times10^{-9}\ m^2$

a Total charge on the plates, $Q = C \times V$

$= 4\times10^{-9}\times10^{-6}\times 200\times10^{9}$

$= 8\times10^{-6}\ C$

b Potential gradient, $E = \frac{dv}{dx} = \frac{2\times10^{9}}{4\times10^{-3}} = 5\times10^{6}\ V/m$

c $D = \frac{Q}{A} = \frac{8\times10^{-6}}{200\times10^{-9}} = 4\times10^{-9}\ C/m^2$

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d

Electric flux density

$$D = \varepsilon_0 \varepsilon_r E$$

$$\Rightarrow \varepsilon_r = \frac{D}{\varepsilon_0 E} = \frac{4\times10^{-4}}{8.854\times10^{-12}\times 5\times10^{6}}$$

$$= 9.035$$

5

a

RMS value of a AC circuit:

If phase is T for a full cycle then we can write

$$\overline{I^2} = \frac{1}{T}\int_0^T I^2\, dt$$

We know for AC circuit $I = I_0 \sin\omega t$

$$\overline{I^2} = \frac{1}{T}\int_0^T (I_0 \sin\omega t)^2\, dt$$

$$= \frac{I_0^2}{T}\int_0^T \sin^2\omega t\, dt$$

$$= \frac{I_0^2}{T}\left[\frac{t}{2} - \frac{\sin(2\omega t)}{4\omega}\right]_0^T$$

$$= \frac{I_0^2}{2T}\left(T - \frac{1}{2\omega}\sin(2\omega T)\right)$$

$$= \frac{I_0^2}{2T}\left(T - \frac{1}{2\omega}\sin\left(2\times\frac{2\pi}{\cancel{T}}\times\cancel{T}\right)\right)$$

$$= \frac{I_0^2}{2T}\times T = \frac{I_0^2}{2}$$

$$I_{rms} = \sqrt{\overline{I^2}} = \sqrt{\frac{I_0^2}{2}} = \frac{1}{\sqrt{2}} I_0$$

b

Given

$V_{rms} = 230\,V$

$C = 26.5 \times 10^{-6} F$

$f = 50\,Hz$

$X_C = \frac{1}{\omega C} = \frac{1 \times 10^6}{2\pi f \times 26.5}$

$= \frac{1 \times 10^6}{2 \times 3.14 \times 50 \times 26.5}$

$= 120.1778\,\Omega$

$V_{max} = \sqrt{2} \times 230$

$= 325.269\,V$

$I_{max} = \frac{325.269}{120.1778} \quad \left(\frac{V_{max}}{X_C}\right)$

$= 2.71\,A$

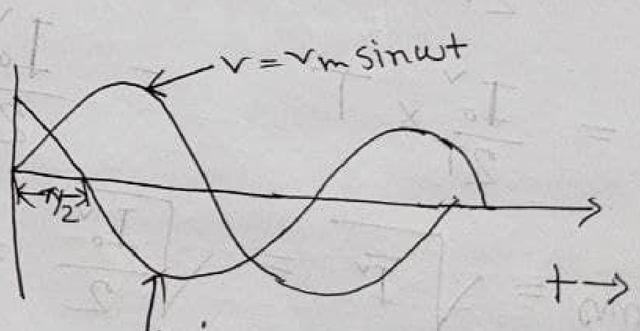
$\varphi = 90^\circ$ (lead)

a. $v(t) = 325.269 \sin(314t)$

$i(t) = 2.71 \sin(314t + \pi/2)$

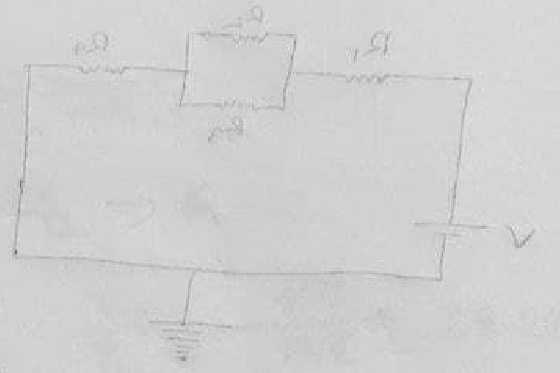
$= 2.71 \cos(314t)$

b



c) $E_{max} = \frac{1}{2} C V_{max}^2 = \frac{1}{2} \times 26.5 \times 10^{-6} \times (325.269)^2$

$= 1.4 J$



c) Given,

$V = 0 + 0.8j = 0.8 \angle 90^\circ$

$I = 0.4 + 0.4j = \frac{2\sqrt{2}}{5} \angle 45^\circ$

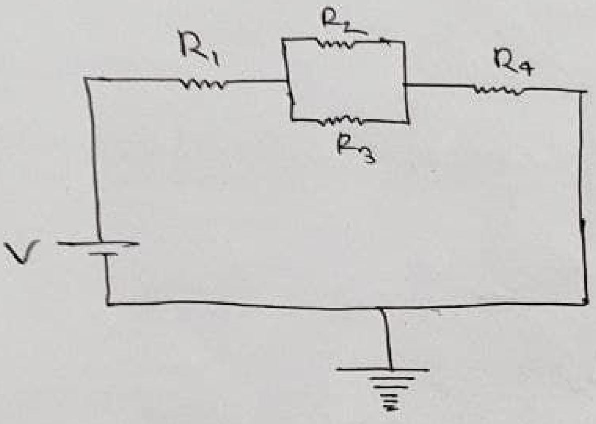
$Z = V/I = \frac{0.8 \angle 90^\circ}{\frac{2\sqrt{2}}{5} \angle 45^\circ} = \sqrt{2} \angle 45^\circ = 1 + j$

$\therefore R = 1$ and $X_L = 1$

Hence the imaginary part is positive so X_L is inductive.

8

9



e

The phase differemec between applied voltage and circuit current is $(55^\circ - 10^\circ) = 45^\circ$ with current lagging. The angular frequency is $\omega = 3000$ rad/sec.

$L = 0.03 H$

$V = 400 \cos(300t - 10^\circ)$

$i = 10\sqrt{2} \cos(3000t - 55^\circ)$

Since current lags $X_L > X_C$.

Net reactance $X = X_L - X_C$ Also $X_L = \omega L$

$= 3000 \times 0.03$

$= 90\Omega$

$\tan\varphi = \frac{X}{R}$

$\Rightarrow \tan 45^\circ = \frac{X}{R} \Rightarrow R = X$.

Now, $Z = \frac{V_m}{I_m} = \frac{400}{10\sqrt{2}} = 28.28\Omega$

$Z^2 = R^2 + X^2 = 2R^2$

$\therefore R = 20$

$\therefore X_C = X_L - X = 90 - 20 = 70$

$\therefore 70 = \frac{1}{\omega C} \Rightarrow C = \frac{1}{3000 \times 70} = 4.76\ \mu F$

Ans