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Lesson-6

GATE 2019
Electrical Engineering

Detailed Solution

- Electric Circuit

*Sub: Electric Circuit or Network Theory.

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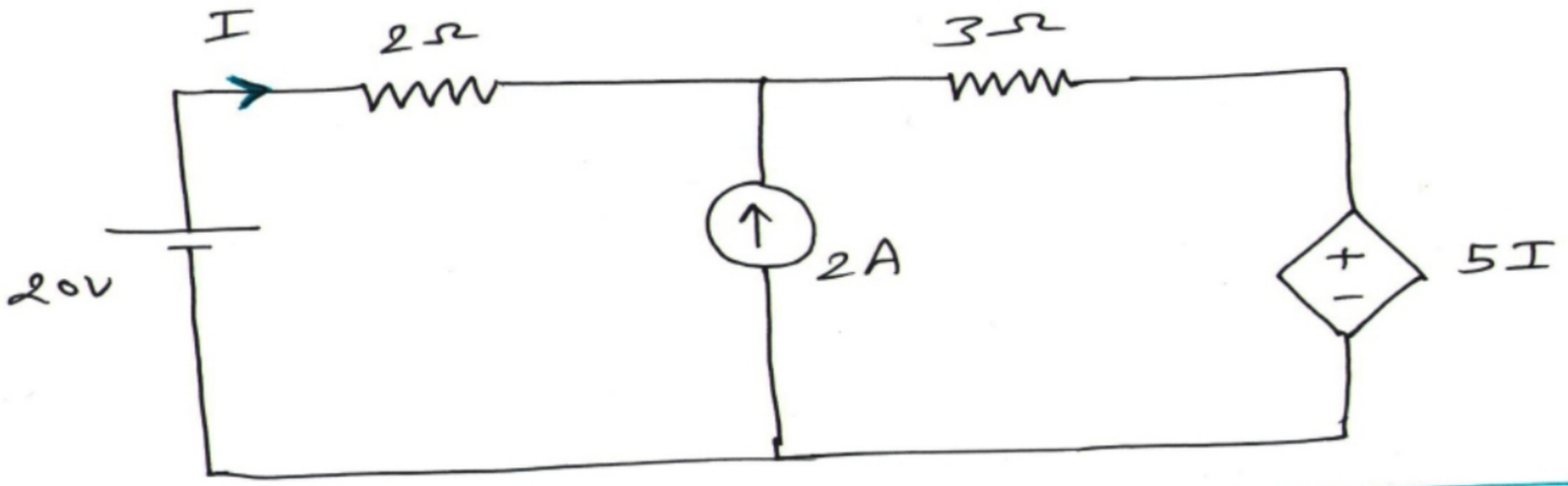
Q-1 The Current I flowing in the circuit shown below in amperes (round off to one decimal place) is _____.

1 M



GATE - 2019
EE
1 mark.

Q-2 2M

A 0.1 μF capacitor charged to 100 V is discharged through a 1 kΩ resistor. The time in ms (round off to two decimal places) required for the voltage across the capacitor to drop to 1 V is _____.

GATE – 2019 – EE
2 marks.

Solution: here, $V(0) = 100\ V$ & due to discharge $V(\infty) = 0$.

$$\Rightarrow V_c(t) = V_c(\infty) + [V_c(0) - V_c(\infty)] \cdot e^{-t/\tau}$$

$$\Rightarrow V_c(t) = 0 + (100 - 0) \cdot e^{-t/\tau}$$

$$\Rightarrow V_c(t) = 100 \cdot e^{-t/\tau}$$

Now, $V_c(t)\big|_{t=t_1} = 1 = 100 \cdot e^{-t_1/\tau}$

$$\Rightarrow e^{t_1/\tau} = 100. \Rightarrow t_1 = \tau \ln(100)$$

$$\Rightarrow t_1 = RC \cdot \ln(100)$$

$$t_1 = 0.46\ \text{msec}$$

So, ans is 0.46 (msec).

Solution:

$$V(t) = -170 \cdot \sin\left(377t - \frac{\pi}{6}\right) V.$$

$$V(t) = 170 \cdot \sin\left(\frac{\pi}{6} - 377t\right) V.$$

Now, $\sin\theta = \cos(90^\circ - \theta)$.

$$v(t) = 170 \cdot \cos\left(\frac{\pi}{2} - \frac{\pi}{6} + 377t\right)$$

$$V(t) = \underset{V_m}{170} \cdot \cos\left(377t + \frac{\pi}{3}\right) V. \quad \rightarrow \phi_1$$

$$i(t) = \underset{I_m}{8} \cdot \cos\left(377t + \frac{\pi}{6}\right) A. \quad \rightarrow \phi_2$$

$$P_{avg} = \frac{V_m \cdot I_m}{2} \cdot \cos(\phi_1 - \phi_2)$$

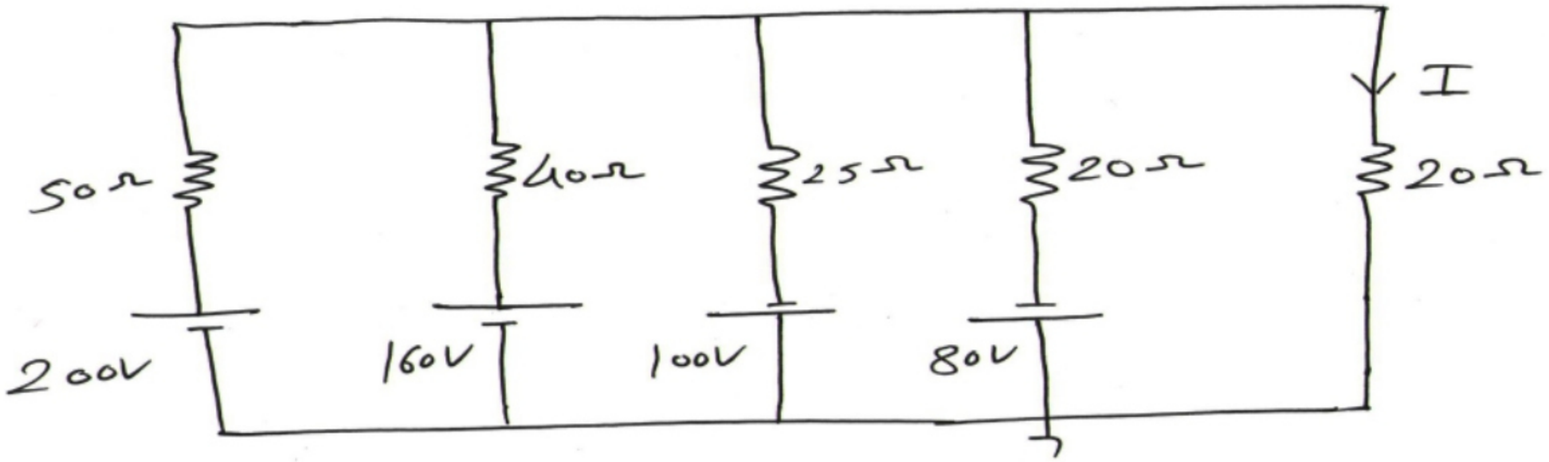
$$P_{avg} = \frac{170 \times 8}{2} \cdot \cos\left(\frac{\pi}{6}\right)$$

$$\boxed{P_{avg} = 588.9 \text{ Watts}}$$

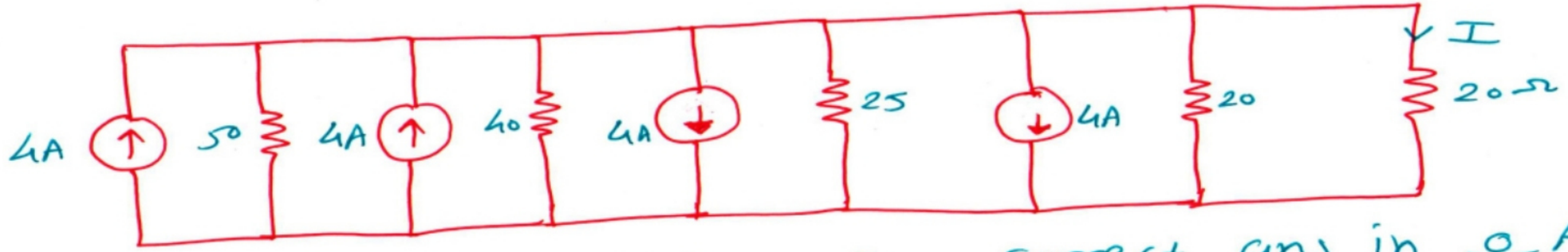
Q-4 The current I flowing in the circuit shown below in amperes is _____.

2M

GATE – 2019
EE
2 mark.



Soln:



$I = 4 + 4 - 4 - 4 = 0\ A$, So, Correct ans in 0 A.

Thank You for Watching

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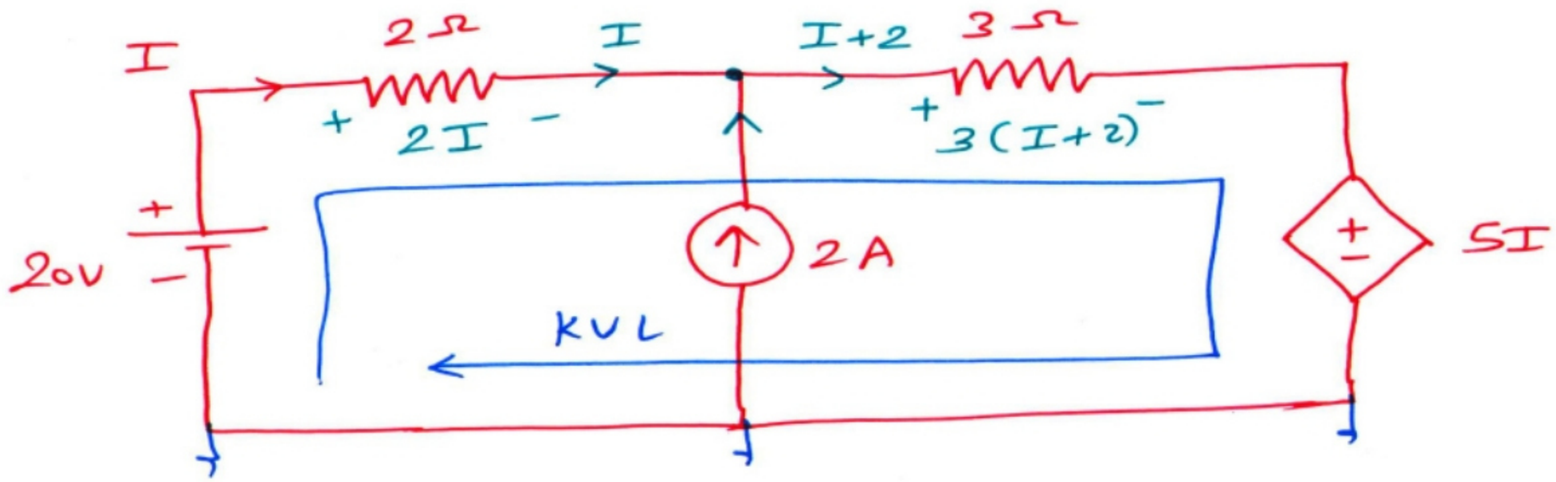
Solution:



KVL

$\Rightarrow 20 - 2I - 3(I+2) - 5I = 0.$

$\Rightarrow 20 - 2I - 3I - 6 - 5I = 0.$

$\Rightarrow 14 = 10I$

So, Correct ans is 1.4 A.

$I = 1.4\ A$

Q-3 The Voltage across and the Current through a

2M are expressed as follows

$$v(t) = -170 \cdot \sin\left(377t - \frac{\pi}{6}\right) V$$

$$i(t) = 8\cos\left(377t + \frac{\pi}{6}\right) A.$$

The average power in watts (round off to one decimal place) consumed by the load is _____.

GATE - 2019
EE
2 mark.