Test 2

Q1 (10-26)

The capacitor in Fig. 10.86 is initially charged to 3 V with the polarity shown.

a. Find the mathematical expressions for the voltage v_C and the current i_C when the switch is closed.

b. Sketch the waveforms for v_C and i_C.

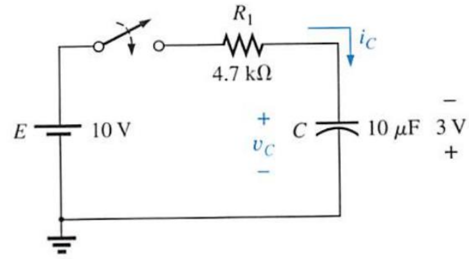


FIG. 10.86

Q2 (12-14)

For the network of Fig. 12.69:

a. Determine the mathematical expressions for the current i_L and the voltage v_L when the switch is closed.

b. Repeat part (a) if the switch is opened after a period of five time constants has passed.

c. Sketch the waveforms of parts (a) and (b) on the same axis.

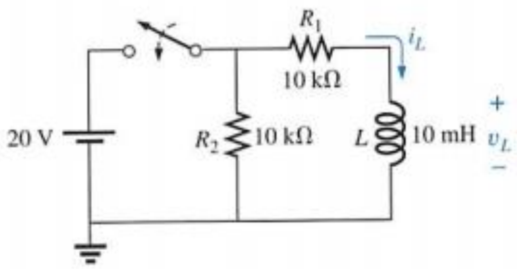


FIG. 12.69

Q3 (13-44)

Find the effective value of the periodic waveform of Fig. 13.95 over one full cycle.

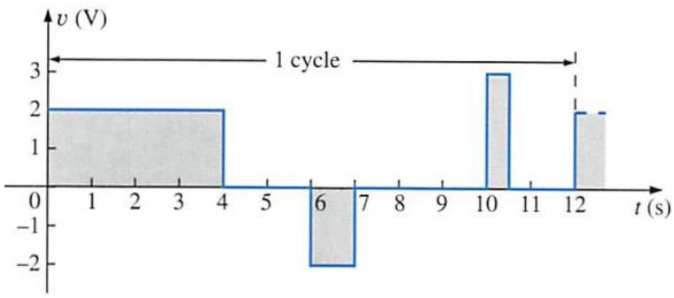


FIG. 13.95

Q4 (14-53)

Find the sinusoidal expression for the current i_s for the system of Fig. 14.82 if

$$i_1 = 6 \times 10^{-3} \sin(377t + 180°)$$
$$i_2 = 8 \times 10^{-3} \sin 377t$$
$$i_3 = 2i_2$$

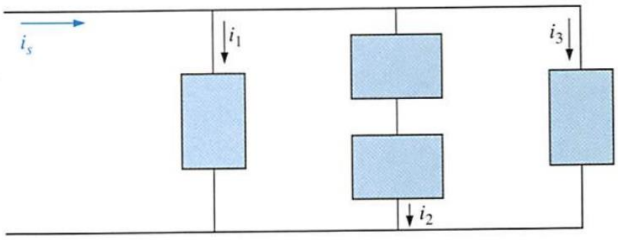


FIG. 14.82

Solution

Q1 (10-26)

a. $\tau = RC = (4.7\text{ k}\Omega)(10\ \mu\text{F}) = 47\text{ ms}$

$v_C = V_f + (V_i - V_f)e^{-t/\tau}$

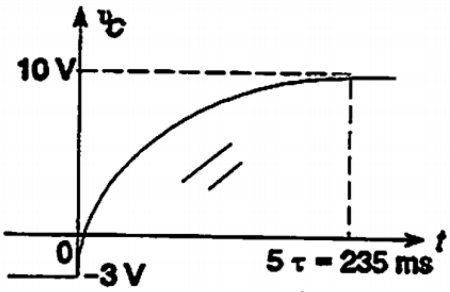
$= 10\text{ V} + (-3\text{ V} - 10\text{ V})e^{-t/47\text{ ms}}$

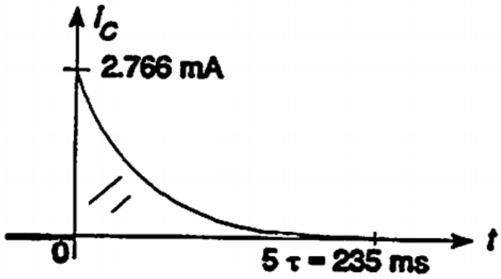
$v_C = 10\text{ V} - 13\text{ V}e^{-t/47\text{ ms}}$

$v_R(0+) = 10\text{ V} + 3\text{ V} = 13\text{ V}$

$i_C = \dfrac{13\text{ V}}{4.7\text{ k}\Omega}e^{-t/47\text{ ms}} = 2.766\text{ mA}e^{-t/47\text{ ms}}$

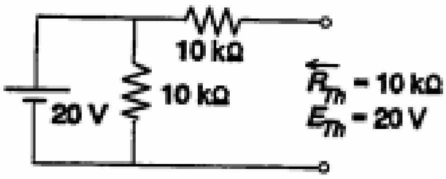
b.





Q2 (12-14)

14. a.



$\tau = \dfrac{L}{R} = \dfrac{10\text{ mH}}{10\text{ k}\Omega} = 1\ \mu\text{s}$

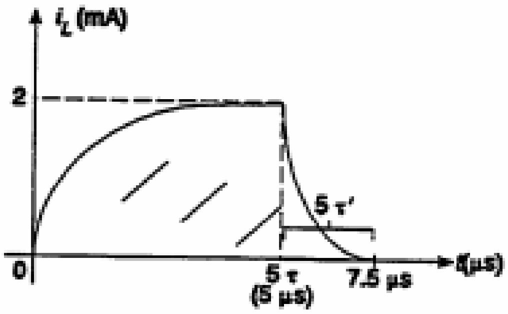
$v_L = 20e^{-t/1\ \mu\text{s}},\ i_L = \dfrac{E}{R}(1 - e^{-t/\tau}) = 2 \times 10^{-3}(1 - e^{-t/1\ \mu\text{s}})$

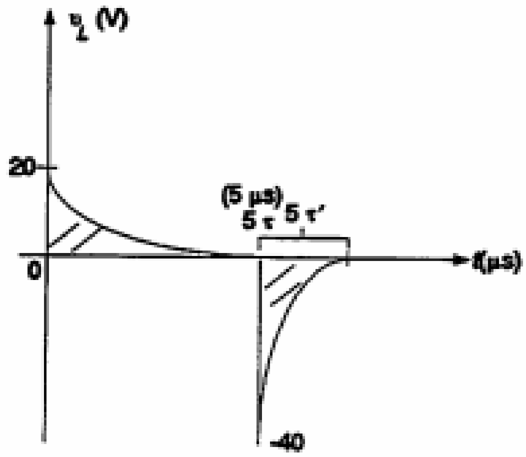
b. $5\tau \Rightarrow$ steady state

$\tau' = \dfrac{L}{R} = \dfrac{10\text{ mH}}{20\text{ k}\Omega} = 0.5\ \mu\text{s}$

$i_L = I_m e^{-t/\tau'} = 2 \times 10^{-3}e^{-t/0.5\ \mu\text{s}}$

$v_L = -(2\text{ mA})(20\text{ k}\Omega)e^{-t/\tau} = -40e^{-t/0.5\ \mu\text{s}}$





Q3 (13-44)

$$V_{\text{eff}} = \sqrt{\frac{(2\text{ V})^2(4\text{ s}) + (-2\text{ V})^2(1\text{ s}) + (3\text{ V})^2\left[\frac{1}{2}\text{s}\right]}{12\text{ s}}} = \mathbf{1.43\ V}$$

Q4 (14-53)

(Using effective values)

$$\mathbf{I}_s = \mathbf{I}_1 + \mathbf{I}_2 + \mathbf{I}_3 = 4.240\text{ mA}\ \angle 180^\circ + 5.656\text{ mA}\ \angle 0^\circ + 11.312\text{ mA}\ \angle 0^\circ$$
$$= -4.242\text{ mA} + 16.968\text{ mA} = 12.726\text{ mA}\ \angle 0^\circ$$
$$i_s = 18 \times 10^{-3} \sin 377t$$