

## Test 2

### Q1 (10-26)

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

- Find the mathematical expressions for the voltage  $v_C$  and the current  $i_C$  when the switch is closed.
- Sketch the waveforms for  $v_C$  and  $i_C$ .

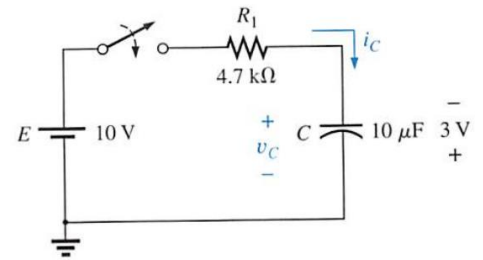


FIG. 10.86

### Q2 (12-14)

For the network of Fig. 12.69:

- Determine the mathematical expressions for the current  $i_L$  and the voltage  $v_L$  when the switch is closed.
- Repeat part (a) if the switch is opened after a period of five time constants has passed.
- Sketch the waveforms of parts (a) and (b) on the same axis.

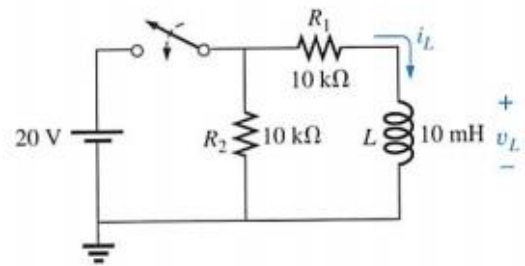


FIG. 12.69

### Q3 (13-44)

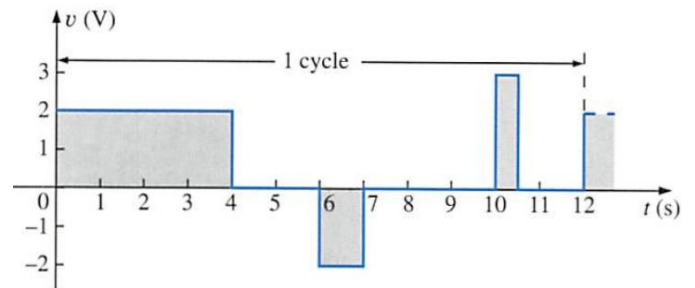


FIG. 13.95

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

### Q4 (14-53)

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

$$i_1 = 6 \times 10^{-3} \sin(377t + 180^\circ)$$

$$i_2 = 8 \times 10^{-3} \sin 377t$$

$$i_3 = 2i_2$$

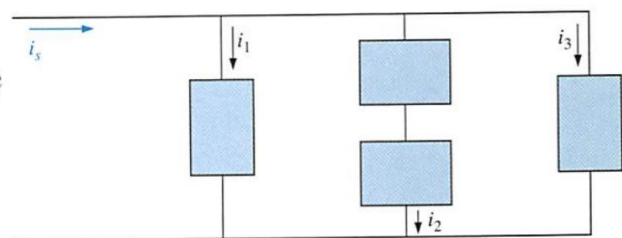


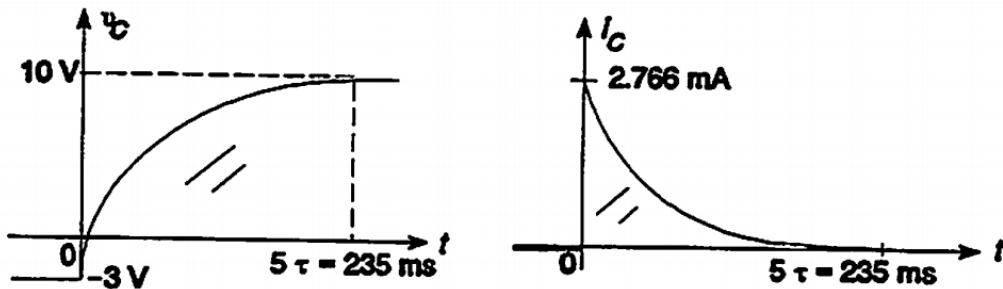
FIG. 14.82

Solution

Q1 (10-26)

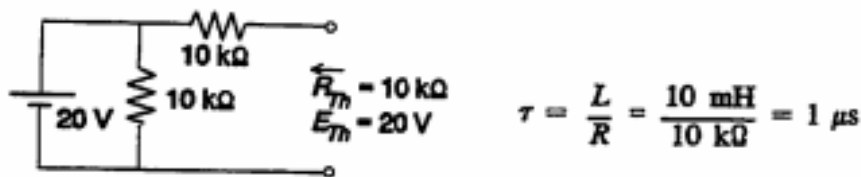
a.  $\tau = RC = (4.7 \text{ k}\Omega)(10 \text{ }\mu\text{F}) = 47 \text{ ms}$   
 $v_C = V_f + (V_i - V_f)e^{-t/\tau}$   
 $= 10 \text{ V} + (-3 \text{ V} - 10 \text{ V})e^{-t/47 \text{ ms}}$   
 $v_C = 10 \text{ V} - 13 \text{ V}e^{-t/47 \text{ ms}}$   
 $v_R(0+) = 10 \text{ V} + 3 \text{ V} = 13 \text{ V}$   
 $i_C = \frac{13 \text{ V}}{4.7 \text{ k}\Omega} e^{-t/47 \text{ ms}} = 2.766 \text{ mA}e^{-t/47 \text{ ms}}$

b.



Q2 (12-14)

14. a.



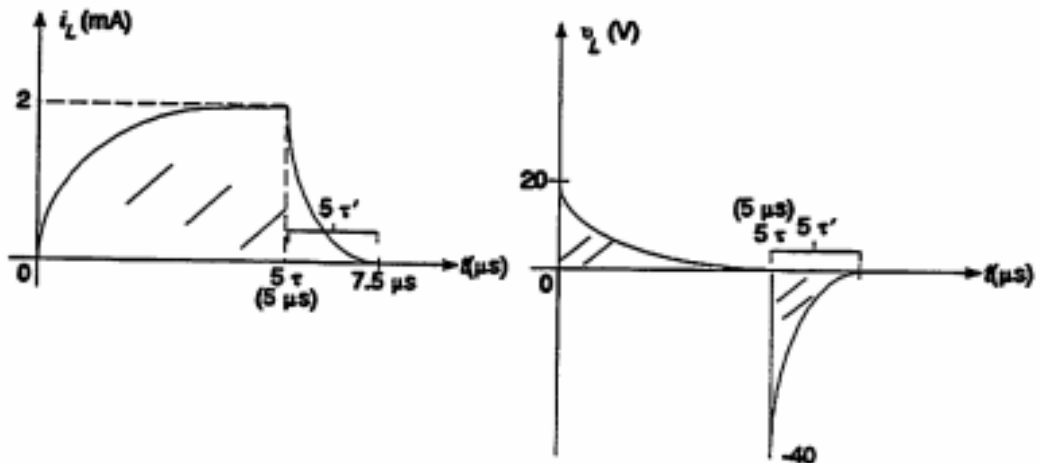
$$v_L = 20e^{-t/1 \mu\text{s}}, i_L = \frac{E}{R}(1 - e^{-t/\tau}) = 2 \times 10^{-3}(1 - e^{-t/1 \mu\text{s}})$$

b.  $5\tau \Rightarrow$  steady state

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

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

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



Q3 (13-44)

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

Q4 (14-53)

(Using effective values)

$$\begin{aligned} I_s &= I_1 + I_2 + I_3 = 4.240 \text{ mA } \angle 180^\circ + 5.656 \text{ mA } \angle 0^\circ + 11.312 \text{ mA } \angle 0^\circ \\ &= -4.242 \text{ mA} + 16.968 \text{ mA} = 12.726 \text{ mA } \angle 0^\circ \end{aligned}$$

$$i_s = 18 \times 10^{-3} \sin 377t$$