Chapter 6, Solution 6.

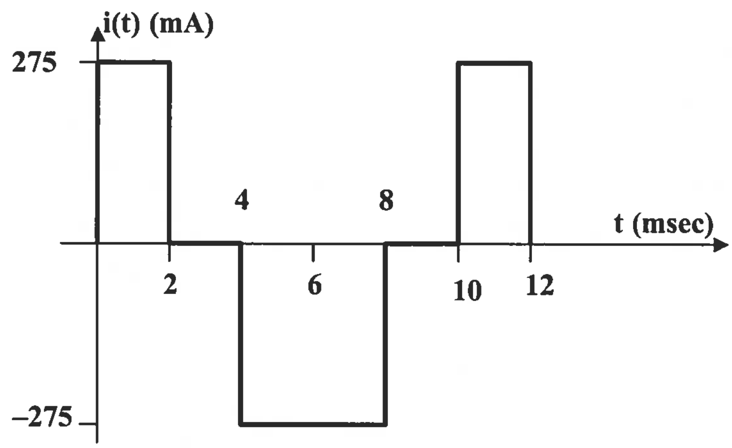
$i = C\frac{dv}{dt} = 55x10^{-6}$ times the slope of the waveform.

For example, for 0 < t < 2,

$$\frac{dv}{dt} = \frac{10}{2x10^{-3}}$$

$$i = C\frac{dv}{dt} = (55x10^{-6})\frac{10}{2x10^{-3}} = 275mA$$

Thus the current i(t) is sketched below.



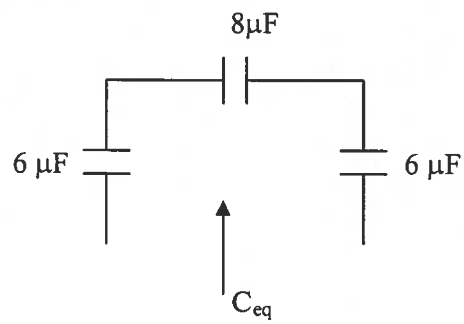
Chapter 6, Solution 12.

$i_R = V/R = (30/12)e^{-2000t} = 2.5\ e^{-2000t}$ and $i_C = C(dv/dt) = 0.1x30(-2000)\ e^{-2000t}$ $= -6000\ e^{-2000t}$ A. Thus, $i = i_R + i_C = -5{,}997.5\ e^{-2000t}$. The power is equal to:

$$vi = \mathbf{-179.925\ e^{-4000t}\ W}.$$

Chapter 6, Solution 18.

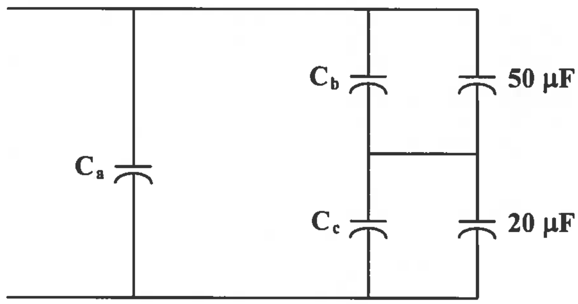
4 μF in parallel with 4 μF = 8μF
4 μF in series with 4 μF = 2 μF
2 μF in parallel with 4 μF = 6 μF
Hence, the circuit is reduced to that shown below.



$$\frac{1}{C_{eq}} = \frac{1}{6} + \frac{1}{6} + \frac{1}{8} = 0.4583 \longrightarrow C_{eq} = \underline{2.1818\ \mu F}$$

Chapter 6, Solution 28.

We may treat this like a resistive circuit and apply delta-wye transformation, except that R is replaced by 1/C.



$$\frac{1}{C_a} = \frac{\left(\frac{1}{10}\right)\left(\frac{1}{40}\right) + \left(\frac{1}{10}\right)\left(\frac{1}{30}\right) + \left(\frac{1}{30}\right)\left(\frac{1}{40}\right)}{\frac{1}{30}}$$

$$= \frac{3}{40} + \frac{1}{10} + \frac{1}{40} = \frac{2}{10}$$

$C_a = 5\mu F$

$$\frac{1}{C_b} = \frac{\frac{1}{400} + \frac{1}{300} + \frac{1}{1200}}{\frac{1}{10}} = \frac{2}{30}$$

$C_b = 15\mu F$

$$\frac{1}{C_c} = \frac{\frac{1}{400} + \frac{1}{300} + \frac{1}{1200}}{\frac{1}{40}} = \frac{4}{15}$$

$C_c = 3.75\mu F$

C_b in parallel with $50\mu F = 50 + 15 = 65\mu F$

C_c in series with $20\mu F = 23.75\mu F$

$65\mu F$ in series with $23.75\mu F = \dfrac{65x23.75}{88.75} = 17.39\mu F$

$17.39\mu F$ in parallel with $C_a = 17.39 + 5 = 22.39\mu F$

Hence $C_{eq} = \mathbf{22.39\mu F}$

Chapter 6, Solution 32.

(a) $C_{eq} = (12x60)/72 = 10\ \mu F$

$$v_1 = \frac{10^{-3}}{12x10^{-6}}\int_0^t 50e^{-2t}dt + v_1(0) = \underline{-2083e^{-2t}\Big|_0^t} + 50 = \underline{-2083e^{-2t} + 2133V}$$

$$v_2 = \frac{10^{-3}}{60x10^{-6}}\int_0^t 50e^{-2t}dt + v_2(0) = \underline{-416.7e^{-2t}\Big|_0^t + 20} = \underline{-416.7e^{-2t} + 436.7V}$$

(b) At t=0.5s,

$$v_1 = -2083e^{-1} + 2133 = 1366.7, \qquad v_2 = -416.7e^{-1} + 436.7 = 283.4$$

$$w_{12\mu F} = \frac{1}{2}x12x10^{-6}x(1366.7)^2 = \underline{11.207\text{ J}}$$

$$w_{20\mu F} = \frac{1}{2}x20x10^{-6}x(283.4)^2 = \underline{803.2\text{ mJ}}$$

$$w_{40\mu F} = \frac{1}{2}x40x10^{-6}x(283.4)^2 = \underline{1.6063\text{ J}}$$