EENG 281 Homework #7 Solutions
Fall 2013

P 6.2 [a] $v = L\dfrac{di}{dt}$

$$= (50 \times 10^{-6})(18)[e^{-10t} - 10te^{-10t}] = 900e^{-10t}(1 - 10t)\,\mu\text{V}$$

[b] $i(200\,\text{ms}) = 18(0.2)(e^{-2}) = 487.21\,\text{mA}$

$v(200\,\text{ms}) = 900(e^{-2})(1 - 2) = -121.8\,\mu\text{V}$

$p(200\,\text{ms}) = vi = (487.21 \times 10^{-3})(-121.8 \times 10^{-6}) = -59.34\,\mu\text{W}$

[c] delivering $59.34\,\mu\text{W}$

[d] $i(200\,\text{ms}) = 487.21\,\text{mA}$ (from part [b])

$$w = \frac{1}{2}Li^2 = \frac{1}{2}(50 \times 10^{-6})(0.48721)^2 = 5.93\,\mu\text{J}$$

[e] The energy is a maximum where the current is a maximum:

$$\frac{di_L}{dt} = 0 \quad \text{when} \quad 1 - 10t = 0 \quad \text{or} \quad t = 0.1\,\text{s}$$

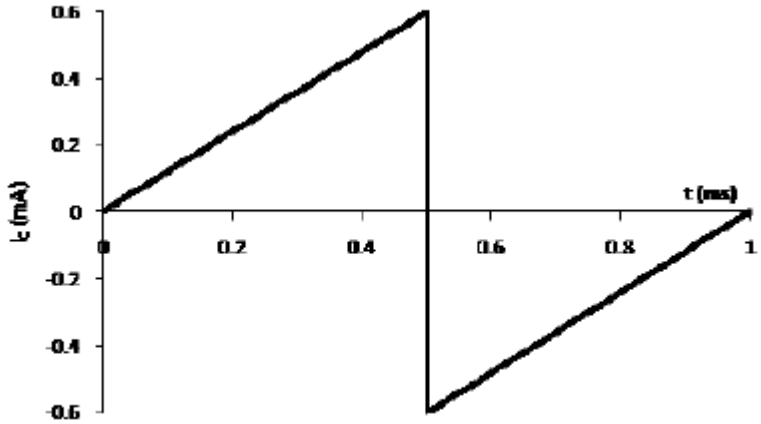
$$i_{\text{max}} = 18(0.1)e^{-1} = 662.18\,\text{mA}$$

$$w_{\text{max}} = \frac{1}{2}(50 \times 10^{-6})(0.66218)^2 = 10.96\,\mu\text{J}$$

P 6.17 $i_C = C(dv/dt)$

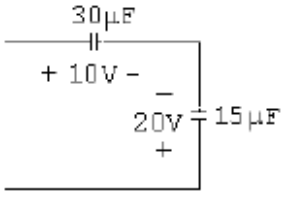
$$0 < t < 0.5: \qquad i_C = 20 \times 10^{-6}(60)t = 1.2t\,\text{mA}$$

$$0.5 < t < 1: \qquad i_C = 20 \times 10^{-6}(60)(t-1) = 1.2(t-1)\,\text{mA}$$



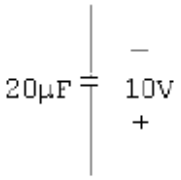
P 6.26 $\dfrac{1}{C_1} = \dfrac{1}{48} + \dfrac{1}{16} = \dfrac{1}{12}; \qquad C_1 = 12\,\mu\text{F}$

$C_2 = 3 + 12 = 15\,\mu\text{F}$

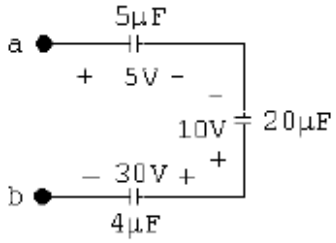


$\dfrac{1}{C_3} = \dfrac{1}{30} + \dfrac{1}{15} = \dfrac{1}{10}; \qquad C_3 = 10\,\mu\text{F}$

$C_4 = 10 + 10 = 20\,\mu\text{F}$



$\dfrac{1}{C_5} = \dfrac{1}{5} + \dfrac{1}{20} + \dfrac{1}{4} = \dfrac{1}{2}; \qquad C_5 = 2\,\mu\text{F}$



Equivalent capacitance is $2\,\mu\text{F}$ with an initial voltage drop of +25 V.

P 6.43 **[a]** Dot terminal 1; the flux is up in coil 1-2, and down in coil 3-4. Assign the current into terminal 4; the flux is down in coil 3-4. Therefore, dot terminal 4. Hence, 1 and 4 or 2 and 3.

[b] Dot terminal 2; the flux is up in coil 1-2, and right-to-left in coil 3-4. Assign the current into terminal 4; the flux is right-to-left in coil 3-4. Therefore, dot terminal 4. Hence, 2 and 4 or 1 and 3.

[c] Dot terminal 2; the flux is up in coil 1-2, and right-to-left in coil 3-4. Assign the current into terminal 4; the flux is right-to-left in coil 3-4. Therefore, dot terminal 4. Hence, 2 and 4 or 1 and 3.

[d] Dot terminal 1; the flux is down in coil 1-2, and down in coil 3-4. Assign the current into terminal 4; the flux is down in coil 3-4. Therefore, dot terminal 4. Hence, 1 and 4 or 2 and 3.

P 6.45 **[a]** $M = 1.0\sqrt{(18)(32)} = 24\,\text{mH}, \qquad i_1 = 6\,\text{A}$

Therefore $16i_2^2 + 144i_2 + 324 = 0, \qquad i_2^2 + 9i_2 + 20.25 = 0$

Therefore $i_2 = -\left(\frac{9}{2}\right) \pm \sqrt{\left(\frac{9}{2}\right)^2 - 20.25} = -4.5 \pm \sqrt{0}$

Therefore $i_2 = -4.5\,\text{A}$

[b] No, setting W equal to a negative value will make the quantity under the square root sign negative.