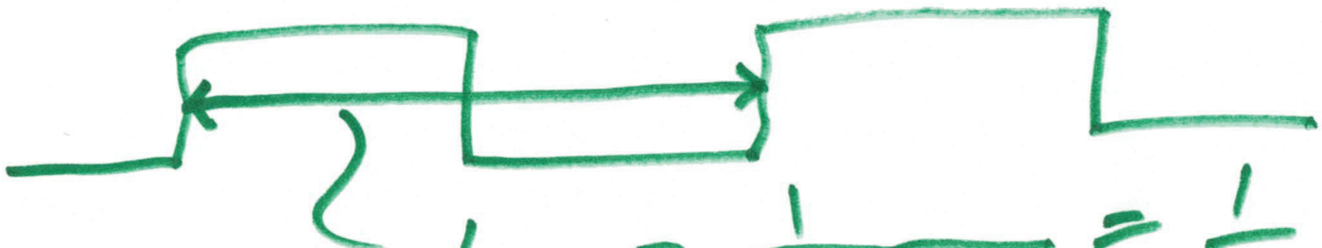
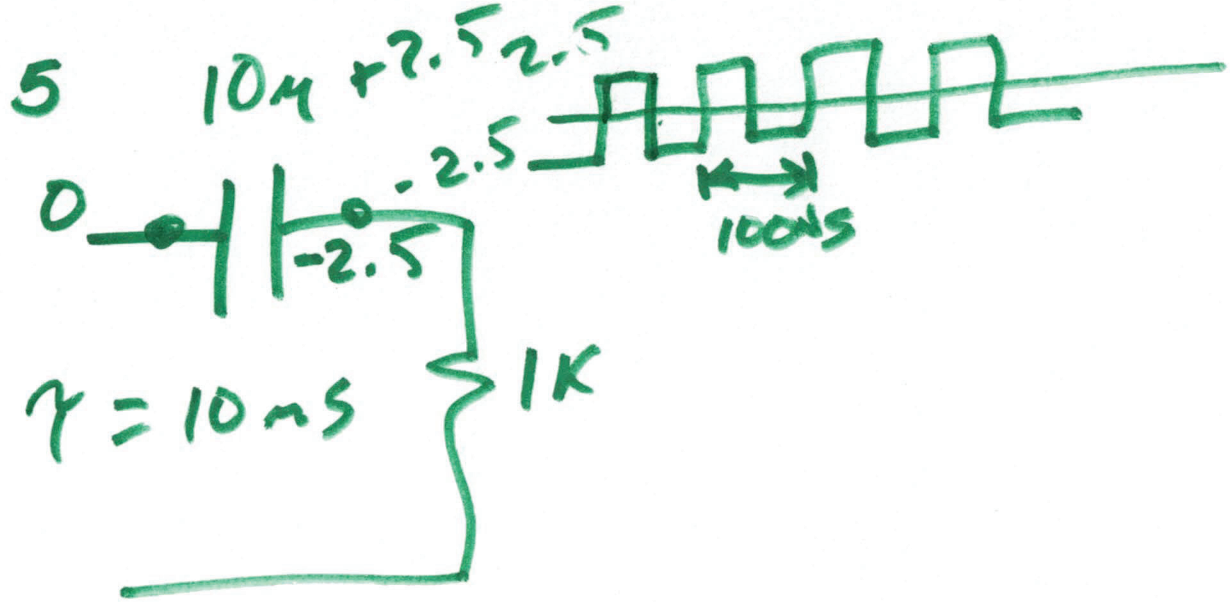
EE 220 Circuits I
November 6, 2023
Lecture 19



$$\frac{1}{10\,MHz} = \frac{1}{10 \times 10^6} = \frac{1}{10^7} = 10^{-7}$$

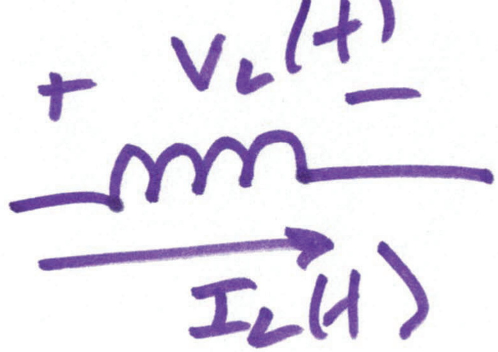
$$10^2 \cdot 10^{-9} = \underline{100\,ns}$$

$$1\,GHz \rightarrow \frac{1}{10^9} = 10^{-9} = 1\,ns$$



$$0 - (-2.5) = 2.5$$

$$5 - (2.5) = 2.5$$



$$P = VI$$

↑ P_{DC}

$$v_L = L \cdot \frac{di_L(t)}{dt} \rightarrow dt = \frac{L}{v_L(t)}\, di_L(t)$$

Apparent power

$$p(t) = v_L(t) \cdot i_L(t)$$

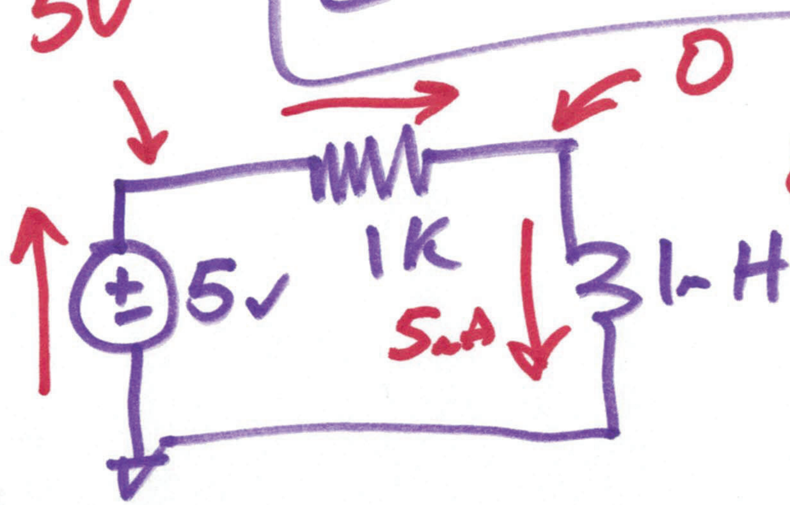
$$\mathcal{E} = \int_{t_1}^{t_2} v_L(t) \cdot i_L(t) \cdot dt$$

$$\int_{t_1,\,0}^{t_2,\,I} L \cdot \frac{di_L(t)}{\not{dt}} \cdot i_L(t) \cdot \not{dt}$$

$$\int_{0}^{I} L \cdot i_L(t) \cdot di_L(t)$$

$$\mathcal{E} = L \frac{x^2}{2} \Big|_{0}^{I_{DC}} = \frac{1}{2} L I_{DC}^2$$

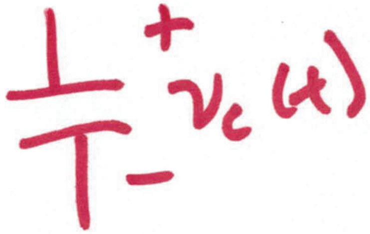
$$\boxed{\mathcal{E} = \frac{1}{2} L I_{DC}^2}$$



$$\mathcal{E} = \frac{1}{2} \cdot 10^{-3} \cdot (5mA)^2$$

$$= \frac{1}{2} \cdot 10^{-3} \cdot 25 \cdot 10^{-6}$$

$$\boxed{= 12.5\ nJ}$$



$$\mathcal{E} = \int_0^Q v_c(t) \cdot dt$$

$$= \frac{1}{2} v_c(t) \Big|_0^Q$$

$$i = C \frac{dv}{dt}$$

$$dt = C \frac{dv}{i}$$

$$\mathcal{E} = \int_{t_1}^{t_2} v_c(t) \cdot i_c(t) \cdot dt$$

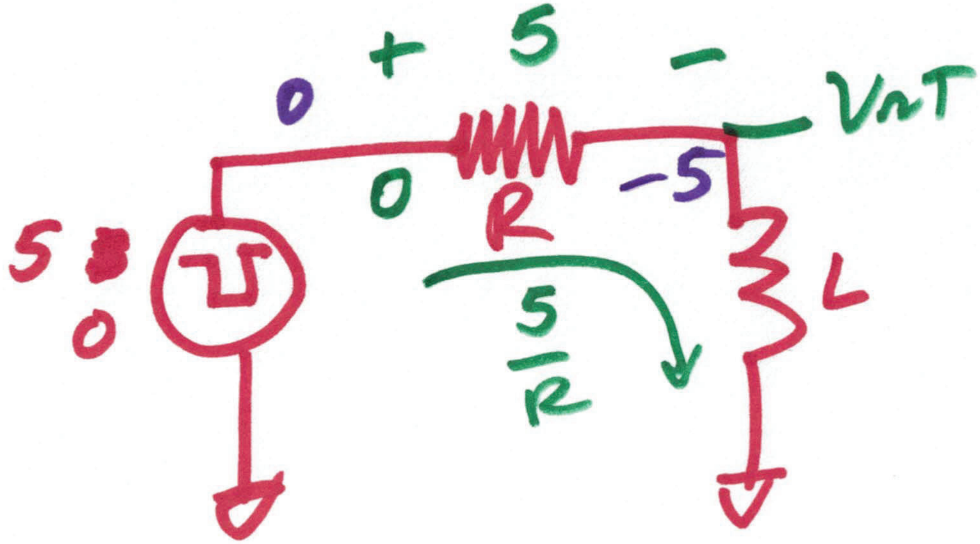
$$= \int_{v_1}^{v_2} v_c(t) \cdot \cancel{i_c(t)} \cdot C \cdot \frac{dv_c(t)}{\cancel{i_c(t)}}$$

$$\mathcal{E} = C \int_{v_1}^{v_2} v_c(t) \cdot dv_c(t)$$

$$\mathcal{E} = C \, \frac{1}{2} x^2 \Big|_{V_1}^{V_2}$$

$$\mathcal{E} = \frac{1}{2} C (V_2 - V_1)^2$$

$$\boxed{\mathcal{E} = \frac{1}{2} C V^2}$$



$pw >> \frac{L}{R}$

$v_i = -5$

$v_f = 0$

$v_i = 5$

$v_f = 0$