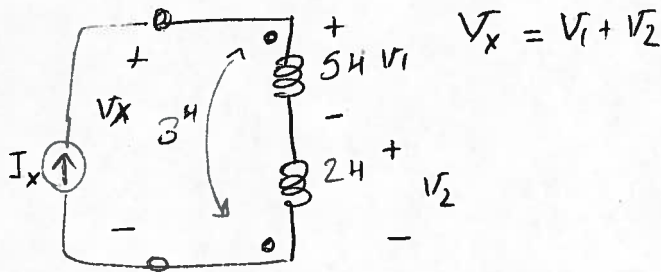


Winter 2014

Q1) a)

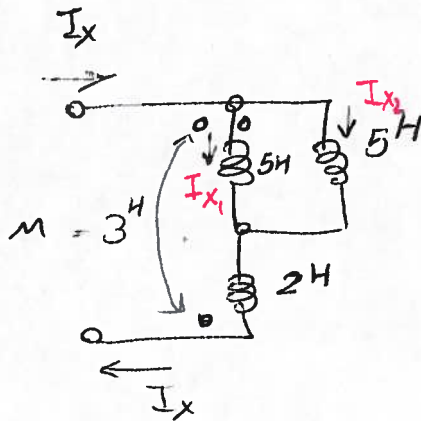


$$V_1 = L_1 \frac{dI_x}{dt} - M \frac{dI_x}{dt} = (2^H) \frac{dI_x}{dt}$$

$$V_2 = L_2 \frac{dI_x}{dt} - M \frac{dI_x}{dt} = (-1^H) \frac{dI_x}{dt}$$

$$\rightarrow V_x = (1^H) \frac{dI_x}{dt} \Rightarrow \underline{L_{\text{equ}} = 1^H}$$

b)



$$\begin{cases} V_1 = (5^H) \frac{dI_{x1}}{dt} - (3^H) \frac{dI_x}{dt} \\ V_2 = (2^H) \frac{dI_x}{dt} - (3^H) \frac{dI_{x1}}{dt} \end{cases}$$

$$(5^H) \frac{dI_{x2}}{dt} = (5^H) \frac{dI_{x1}}{dt} - (3^H) \frac{dI_{x1}}{dt}$$

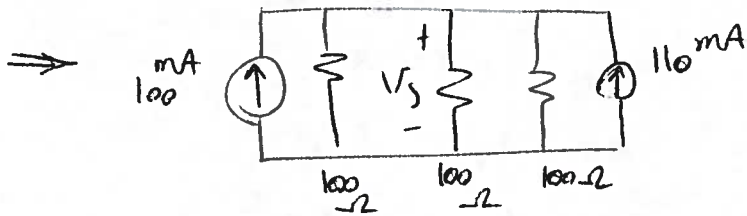
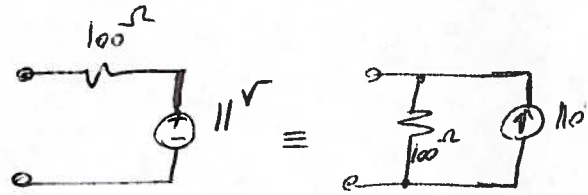
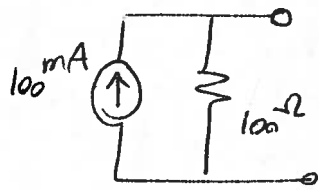
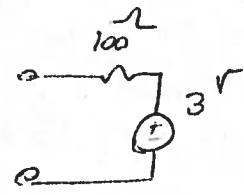
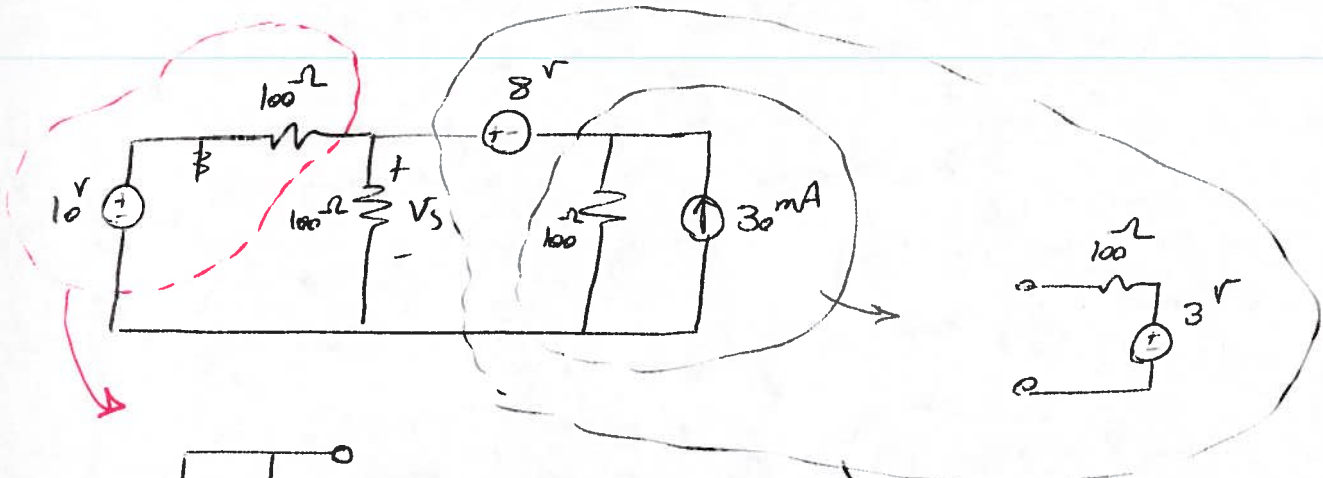
$$\rightarrow (8^H) \frac{dI_{x2}}{dt} = (2^H) \frac{dI_{x1}}{dt}$$

$$\rightarrow \frac{dI_{x1}}{dt} = 4 \frac{dI_{x2}}{dt} = \frac{4}{5} \frac{dI_x}{dt}$$

$$\Rightarrow V_x = V_1 + V_2 = \left(4 - 3 + 2 - \frac{12}{5}\right) \frac{dI_x}{dt}$$

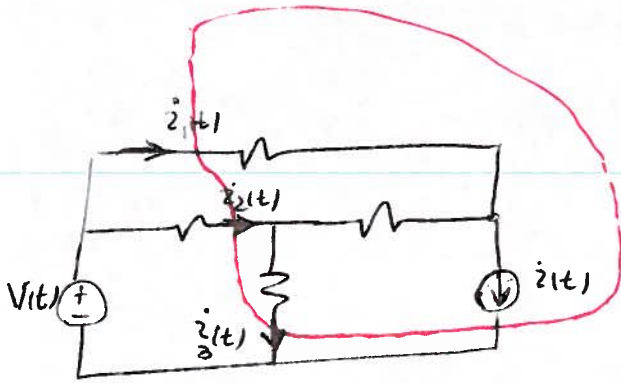
$$\rightarrow \underline{L_{\text{equ}} = 3 - \frac{12}{5} = 3 - 2.4 = 0.6 \text{ H}}$$

Q2)



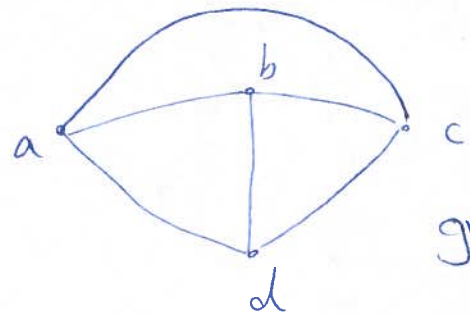
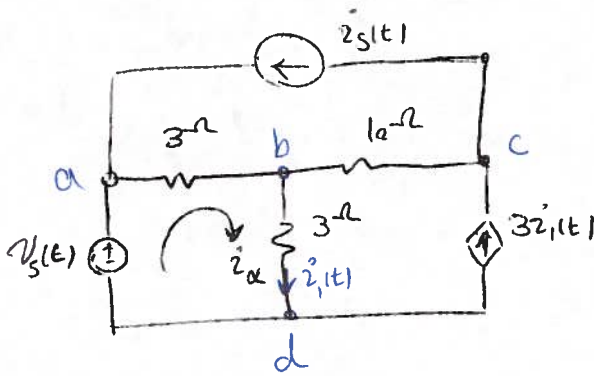
$$V_S = \frac{1}{3} (100\Omega) (210\text{mA}) = 7\text{V}$$

Q3)

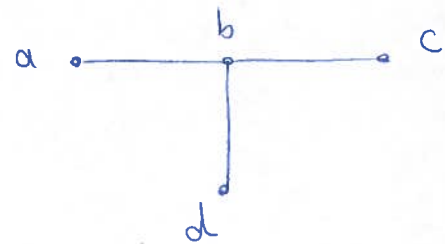


$$\Rightarrow \dot{i}_2(t) + \dot{i}_3(t) = \dot{i}_1(t) + \dot{i}_2(t)$$

Q4)

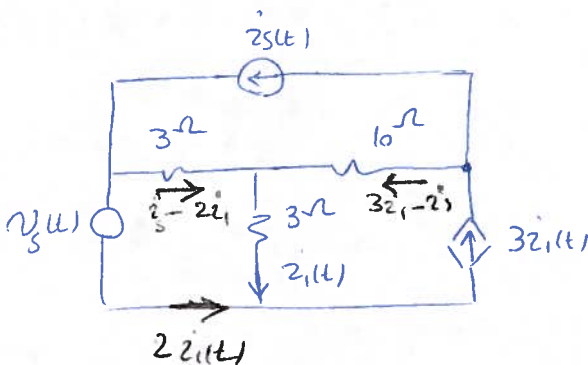


graph  
↓ Spanning Tree



$i_2$  corresponds to chord 'ad'

b)



$$\text{KVL: } v_s(t) = 3^{\Omega} (i_s(t) - 2i_1(t)) + 3^{\Omega} i_1(t)$$

$$\rightarrow v_s(t) - 3i_s(t) = -3i_1(t)$$

$$i_1(t) = i_s(t) - \frac{1}{3} v_s(t)$$