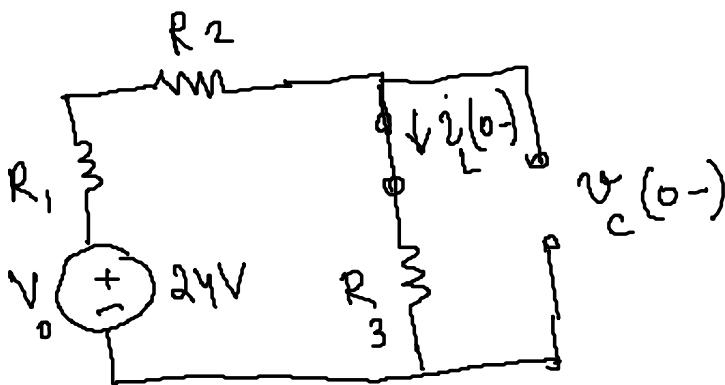


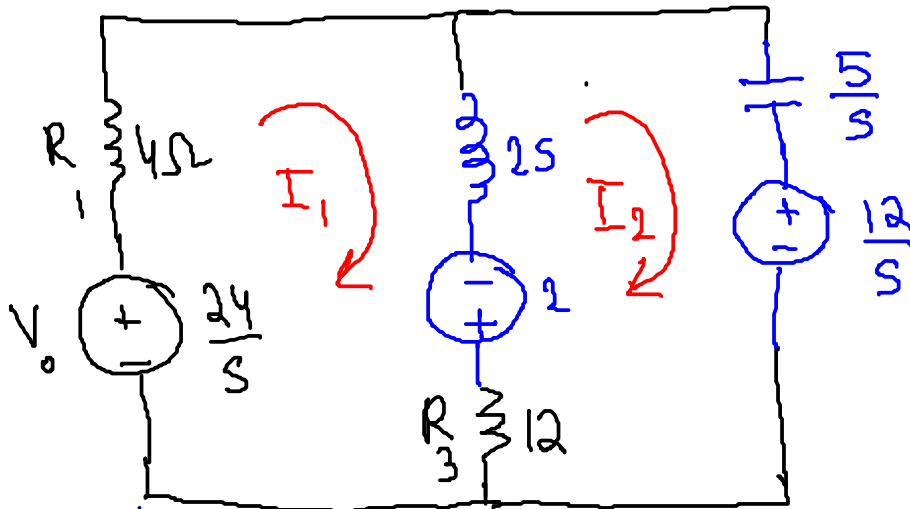
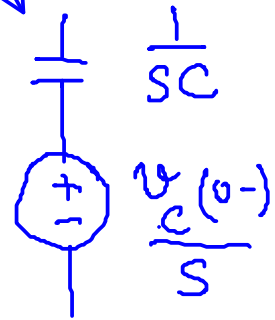
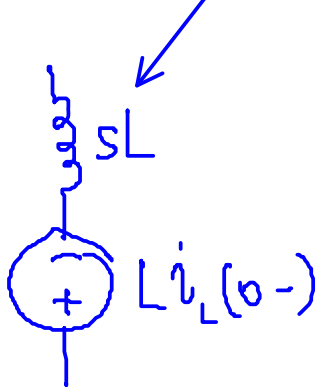
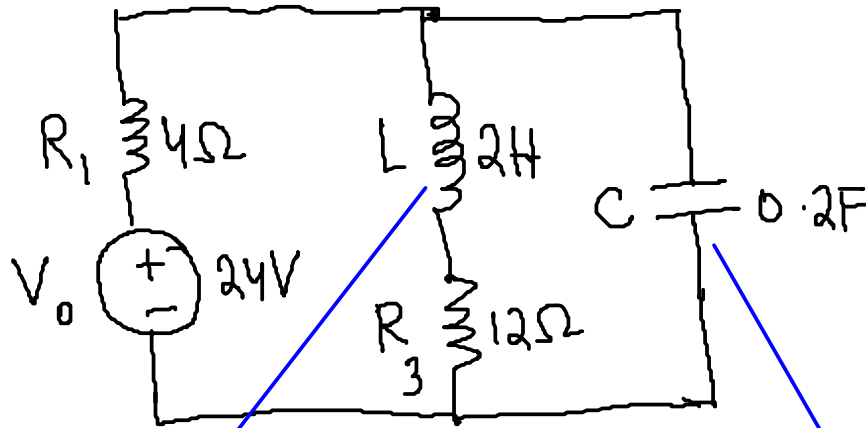
$t = 0^-$

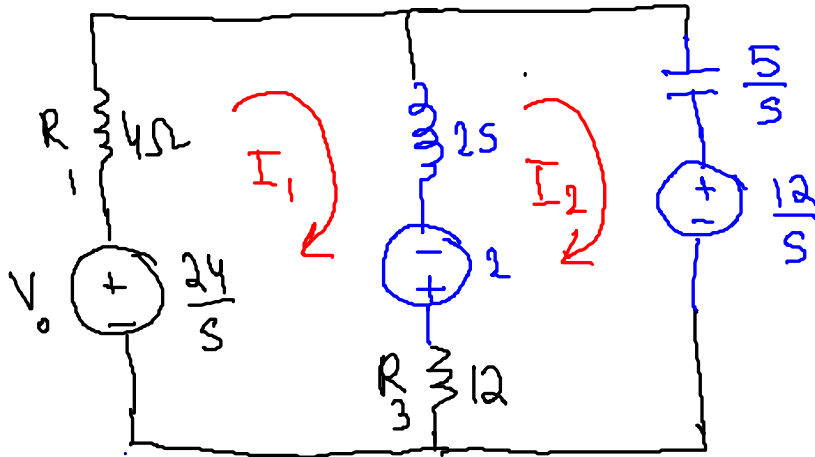


$$i_L(0^-) = \frac{V_0}{R_1 + R_2 + R_3} = \frac{24V}{24\Omega} = 1A$$

$$v_c(0^-) = R_3 i_L(0^-) = (12\Omega)(1A) = 12V$$

$t > 0$





$$-\frac{24}{s} + 4I_1 + 2s(I_1 - I_2) - 2 + 12(I_1 - I_2) = 0$$

$$12(I_2 - I_1) + 2 + 2s(I_2 - I_1) + \frac{5}{s}I_2 + \frac{12}{s} = 0$$

$$I_1 = \frac{12s^2 + 77s + 60}{s(4s^2 + 29s + 40)}$$

$$I_2 = \frac{8(s+6)}{4s^2 + 29s + 40}$$

$$I_L = I_1 - I_2 = \frac{4s^2 + 29s + 60}{4s^3 + 29s^2 + 40s}$$

Lecture 65 - Page4

```
>> b = [4 29 60];  
>> a = [4 29 40 0];  
>> [r p k] = residue(b,a)
```

r =

```
0.2614  
-0.7614  
1.5000
```

p =

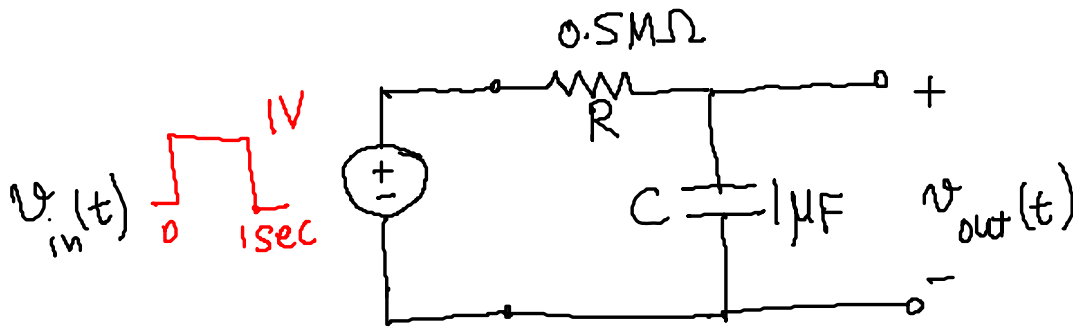
```
-5.3972  
-1.8528  
0
```

k =

```
[]
```

$$\gg I_L = \frac{0.26}{s+5.4} - \frac{0.76}{s+1.85} + \frac{1.5}{s}$$

$$\dot{v}_L(t) = \left[1.5 - 0.76e^{-1.85t} + 0.26e^{-5.4t} \right] \theta(t)$$



zero initial conditions
 ↓ s-domain

$$v_{in}(t) = [u(t) - u(t-1)] \text{ V}$$

$$V_{in}(s) = \frac{1}{s} - e^{-s} \frac{1}{s} = \frac{1}{s} (1 - e^{-s}) \text{ V}$$

$$\begin{aligned} V_{out}(s) &= \frac{\frac{1}{sC}}{R + \frac{1}{sC}} V_{in}(s) \\ &= \frac{1}{1 + sCR} V_{in}(s) = \left(\frac{2}{s+2} \right) \frac{1}{s} (1 - e^{-s}) \end{aligned}$$

$$\begin{aligned} V_{out}(s) &= 2(1 - e^{-s}) \frac{1}{s} \left(\frac{2}{s+2} \right) \\ &= 2(1 - e^{-s}) \left[\frac{0.5}{s} - \frac{0.5}{s+2} \right] \\ &= (1 - e^{-s}) \left[\frac{1}{s} - \frac{1}{s+2} \right] \end{aligned}$$

$$V_{out}(s) = \frac{1}{s} - \frac{1}{s+2} - \frac{1}{s} e^{-s} + \frac{1}{s+2} e^{-s}$$

$$u(t) \leftrightarrow \frac{1}{s}$$

$$e^{-2t} u(t) \leftrightarrow \frac{1}{s+2}$$

$$u(t-1) \leftrightarrow \frac{1}{s} e^{-s}$$

$$e^{-2t} u(t) \leftrightarrow \frac{1}{s+2}$$

$$e^{-2(t-1)} u(t-1) \leftrightarrow \frac{1}{s+2} e^{-s}$$

$$v_{out}(t) = \left[(1 - e^{-2t}) u(t) - (1 - e^{-2(t-1)}) u(t-1) \right]$$

