ECE 4320/5230

TOPIC 4

Slide 21

- To find the time where $V_L(t) = 0.5\,V_0$, we do the following, let $t = t_d$ and we start @ T_D

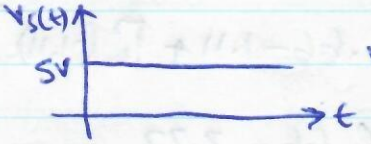
$$V_L(t_d) = V_0 - e^{-\frac{t_d}{T_c}} V_0$$

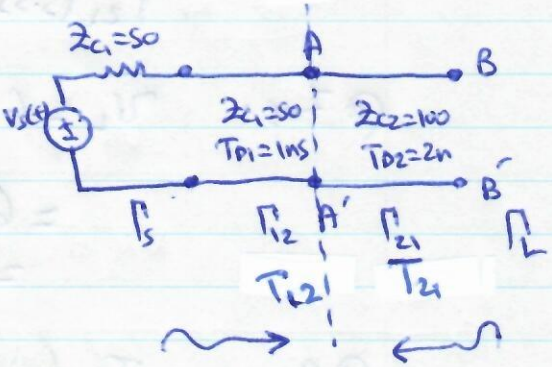
$$0.5V_0 = V_0 - e^{-\frac{t_d}{T_c}} V_0$$

$$0.5 = 1 - e^{-\frac{t_d}{T_c}} \rightsquigarrow e^{-\frac{t_d}{T_c}} = 0.5$$

$$-\frac{t_d}{T_c} = \ln(0.5) = -0.693 \Rightarrow \boxed{t_d = 0.693\,T_c}$$

Example 4.2





$\Gamma_s = 0$, $\Gamma_L = 1$

$$\rightsquigarrow \begin{cases} \Gamma_{12} = \dfrac{Z_{c2} - Z_{c1}}{Z_{c2} + Z_{c1}} = \dfrac{100-50}{150} = \dfrac{50}{150} = \dfrac{1}{3} \\ T_{12} = \dfrac{2Z_{c2}}{Z_{c1} + Z_{c2}} = \dfrac{200}{150} = \dfrac{4}{3} \end{cases}$$

$$\leftsquigarrow \begin{cases} \Gamma_{21} = \dfrac{Z_{c1} - Z_{c2}}{Z_{c1} + Z_{c2}} = \dfrac{50-100}{150} = \dfrac{-1}{3} \\ T_{21} = 1 + \Gamma_{21} = \dfrac{2}{3} \end{cases}$$

$$V_{init} = 5 \frac{Z_{c_1}}{Z_{c_1} + Z_{c_1}} = 2.5(V)$$

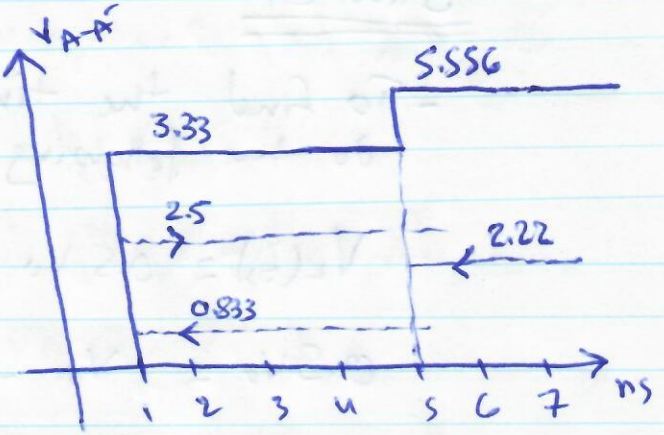
@ 1ns : $v_{1r} = \Gamma_{12}(2.5) = 0.833(V)$

$v_{2t} = T_{12}(2.5) = 3.33V$

@ 3ns : $v_{2t} = 3.33V$

$v_{L,r} = \Gamma_L v_L = 3.33V$

$v_L = v_{2t} + v_{L,r} = 6.66V$



@ 5ns: $T_{21}(3.33) = 2.22V$

$\Gamma_{21}(3.33) = -1.11V$

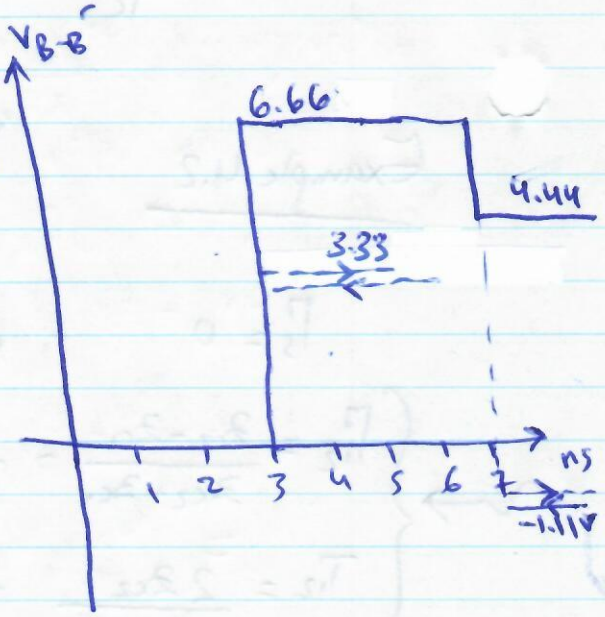
@ 7ns : $v_L = 6.66 - 1.11 + \Gamma_L(-1.11)$

$= 6.66 - 2.22$

$= 4.44\ (V)$

@ 9ns : $T_{21}(-1.11) = -0.741$ → to source

$\Gamma_{21}(-1.11) = 0.37$ → to Load



& continues. See full graph on Slide 28 of T4 Lecture