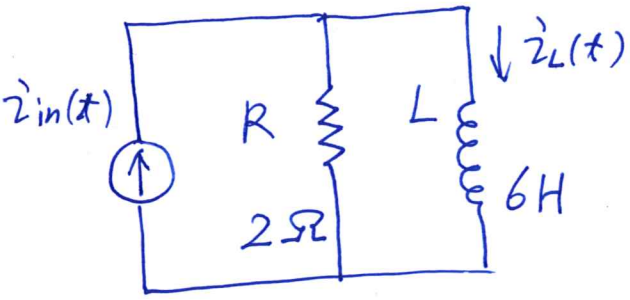
ECEN3714 **Homework #08**

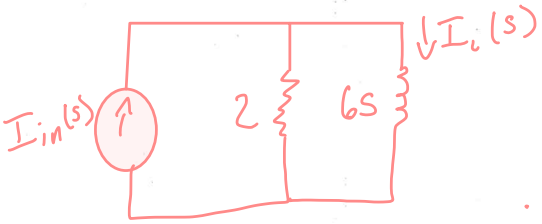
Lab on__ (Wed) __Thu ___Fri_____ Name (PRINT): Bennett (LAST NAME), Roger (Frist Name)

(Pay attention to the notation completeness and rigor of analytics).

8.1. Find the output $i_L(t)$ of the following circuit for an input of $i_{in}(t) = 10\sin(7t)u(t)$ (10 points)



L.T.



$$\dot{z}_{in}(t) = 10\sin(7t)u(t)$$

$$I_{in}(s) = 10\,\frac{7}{s^2+49}\cdot\frac{1}{s} = 10\,\frac{7}{s(s^2+49)}$$

$$I_L(s) = H(s)\cdot I_{in}(s)$$

$$H(s) = \frac{2}{6s+2} = \frac{1/3}{s+1/3}$$

$$(s+1/3)(s^3+49s)$$

$$s^4+49s^2+\tfrac{1}{3}s^3+\tfrac{49}{3}s$$

$$s^4+\tfrac{1}{3}s^3+49s^2+\tfrac{49}{3}s$$

$$I_L(s) = 10\,\frac{1/3}{s+1/3}\cdot\frac{7}{s(s^2+49)} = \frac{70/3}{(s+3)(s)(s^2+7^2)}$$

$$\frac{\frac{70}{3}}{(s+3)(s)(s+7)^2} = \frac{K_1}{s+3} + \frac{K_2}{s} + \frac{K_3}{(s+7)^2}$$

$x\,(s+3)\,/\,s=-3$

$$\frac{\frac{70}{3}}{(s)(s+7)^2} = K_1 \Rightarrow \frac{\frac{70}{3}}{(-3)(8)} = \frac{\frac{70}{3}}{(-24)} \Rightarrow K_1 = -\frac{35}{36}$$

$\times (s) \,/\, s=0$

$$\frac{\frac{70}{3}}{(3)(49)} = K_2 \Rightarrow \frac{\frac{70}{3}}{147} = K_2 \Rightarrow K_2 = \frac{10}{63}$$

$\times (s+7)^2 \quad / \; s=-7$

$$\frac{\frac{70}{3}}{(s+3)(s)} = K_3 \Rightarrow K_3 = \frac{\frac{70}{3}}{(-4)(-7)} \Rightarrow K_3 = \frac{\frac{70}{3}}{28} \Rightarrow K_3 = \frac{5}{6}$$

$$\frac{\frac{70}{3}}{(s+3)(s)(s+7)^2} = \frac{-\frac{35}{36}}{s+3} + \frac{\frac{10}{63}}{s} + \frac{\frac{5}{6}}{s^2+49}$$

$$= -\frac{35}{36}\frac{1}{s+3} + \frac{10}{63}\frac{1}{s} + \frac{5}{6}\frac{1}{s^2+49}$$

$$\dot{i}_L(t) = -\frac{35}{36}\exp(t-3)\,u(t) + \frac{10}{63}u(t) + \frac{5}{6}\left(\frac{1}{7}\sin(7t)\right)u(t)$$

$$= \left[-\frac{35}{36}\exp(t-3) + \frac{10}{63} + \frac{5}{42}\sin(7t)\right]u(t)$$