ECEN3714 **Homework #05**

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

(LAST NAME) (Frist Name)

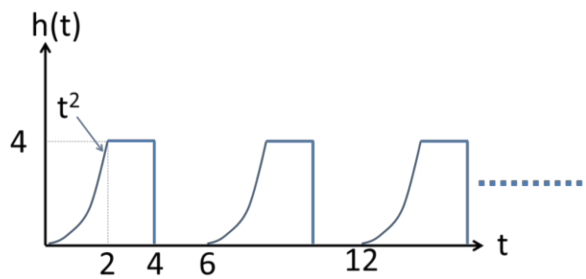
(Pay attention to the notation completeness and rigor of analytics).

5.1. A periodical function $h(t)$ is shown in the following figure. Apparently it has a period of 6, and within the first period, it varies over [0 4]. Let's denote the function within this first period as $h_1(t)$. **(5 points)**

(a). Represent $h_1(t)$ using unit step functions. (2 points)

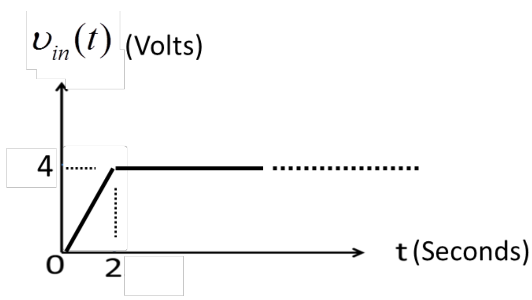
(b). Determine the Laplace transform $F_1(s)$ of $h_1(t)$. (2 points)

(c). Determine the Laplace transform $F(s)$ of $h(t)$ (1 points)



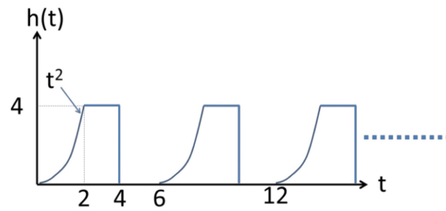
5.2 (a) Express the function $\upsilon_{in}(t)$ shown in the following figure by using step functions. (2 points)

(b) Find the Laplace transform $V_{in}(s)$ of the $\upsilon_{in}(t)$ by using LT tables/properties (3 points)



All Answers and work is on Second Page

5.1.



a.) $h_1(t) = t^2[u(t) - u(t-2)] \cdot 4[u(t-2) - u(t-4)]$

$= [t^2 u(t) - t^2 u(t-2)] \cdot [4u(t-2) - u(t-4)]$

$= [t^2 u(t) - ((t-2)+2)^2 u(t-2)] \cdot [4u(t-2) - u(t-4)]$

$= [t^2 u(t) - [(t-2)^2 + 4(t-2) + 4]\, u(t-2)] \cdot [4u(t-2) - u(t-4)]$

$= [t^2 u(t) - (t-2)^2 u(t-2) + 4(t-2)\,u(t-2) + 4u(t-2)] \cdot [4u(t-2) - u(t-4)]$

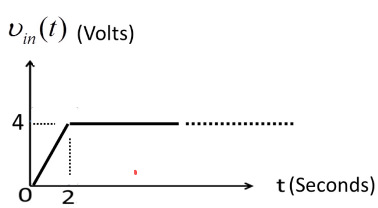
b.)

$F_1(s) = \left[\frac{2}{s^3} - e^{-2s}\frac{2}{s^3} + 4e^{-2s}\frac{1}{s^2} + 4e^{-2s}\frac{1}{s}\right] \cdot \left[4e^{-2s}\frac{1}{s} - e^{-4s}\frac{1}{s}\right]$

c.)

$$F(s) = \frac{F_1(s)}{1 - e^{-Ts}} = \frac{\left[\frac{2}{s^3} - e^{-2s}\frac{2}{s^3} + 4e^{-2s}\frac{1}{s^2} + 4e^{-2s}\frac{1}{s}\right] \cdot \left[4e^{-2s}\frac{1}{s} - e^{-4s}\frac{1}{s}\right]}{1 - e^{-6s}}$$

5.2.



a.) $V_{in}(t) = 2t[u(t) - u(t-2)]\,u(t)$

$= [2u(t) \cdot tu(t)] - [tu(t-2) \cdot 2u(t)]$

$= [2u(t) \cdot tu(t)] - [(t-2)+2 \cdot u(t-2) \cdot 2u(t)]$

$= [2u(t) \cdot tu(t)] - [(t-2)u(t-2) + 2u(t-2) \cdot 2u(t)]$

b.)

$V_{in}(s) = \left[\frac{2}{s} \cdot \frac{1}{s^2}\right] - \left[\left(e^{-2s}\frac{1}{s^2} + 2e^{-2s}\frac{1}{s}\right) \cdot \left(\frac{2}{s}\right)\right]$

$= \left[\frac{2}{s^3}\right] - \left[e^{-2s}\frac{2}{s^3} + 2e^{-2s}\frac{2}{s^2}\right]$