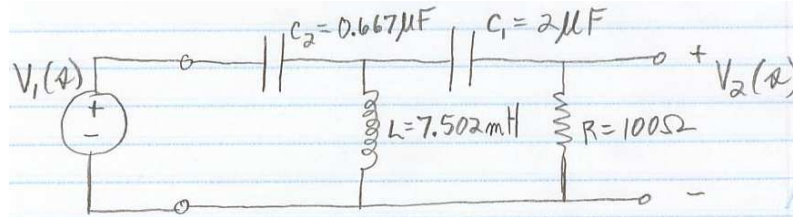


**Answers to EEE311 final exam AY2018-2019**

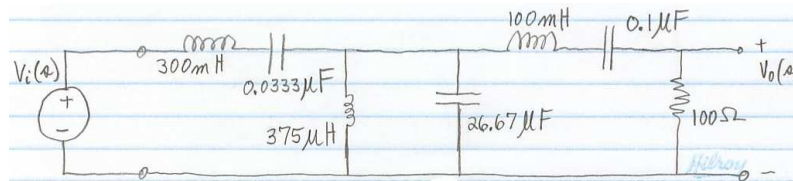
1. (a) The system is linear and non-invariant (it is also causal).
- (b) i.  $h(t) = u(t)$ ; the unit-step function.  
 ii.  $y(t) = \left(\frac{1-e^{-10t}}{2}\right)u(t)$ .
2. (a) Just substitute the values in the transfer function and we obtain:

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

- (b)  $L_1 = 5 \text{ mH}$ ,  $L_2 = 15 \text{ mH}$ ,  $C = 1.33 \mu\text{F}$ .
- (c) The high-pass filter is:



- (d) The band-pass filter is:



The lower and upper cut-off frequencies are:  $f_L = 1.552 \text{ kHz}$ ,  $f_H = 1.632 \text{ kHz}$ .

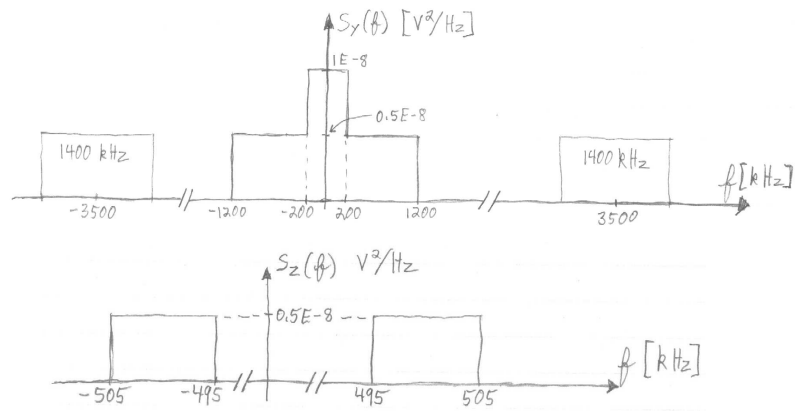
3. (a) Most likely drawn from urn #2. The probability of error by choosing urn #2 is  $1/3$ .
- (b) Most likely drawn from urn #3.
4. (a)

$$p_Y(y) = \begin{cases} \frac{e^{-y/2}}{2} & ; y \geq 0 \\ 0 & ; y < 0 \end{cases}$$

$Y$  is an exponential random variable.

- (b)  $P(Z > 5) = Q(1.5) \approx 0.066807201$ .
- (c)  $P(X_3 > 2.5) = Q(1.5) \approx 0.066807201$ .

5. (a) i.  $f_0 = 1.5 \text{ MHz}$  or  $2.5 \text{ MHz}$ ,  $A = 2$ .  
 ii.  $W = 10 \text{ kHz}$ .  
 (b) i.



- ii.  $-26.99 \text{ dBm}$  ( $50 \Omega$ ).