Name:

Problem	Points	Score
1a	10	
1b	10	
1c	10	
1d	10	
2a	10	
2b	10	
2c	10	
3a	10	
3b	10	
3c	10	
Total	100	

Notes:

1. The exam is closed books/closed notes - except for one page of notes.

2. Please show ALL work. Incorrect answers with no supporting explanations or work will be given no partial credit.

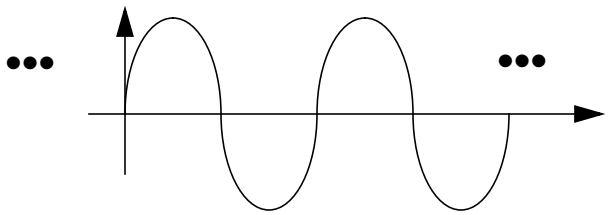
3. Please indicate clearly your answer to the problem.

I hereby promise not to discuss this exam with anyone in the MWF section of EE 3133.

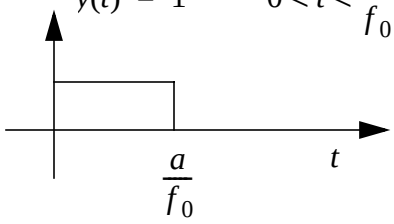
Signature: _____

Problem No. 1:

$x(t) = \sin 2\pi f_0 t$

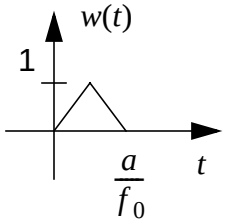


$y(t) = 1 \qquad 0 < t < \frac{a}{f_0}$

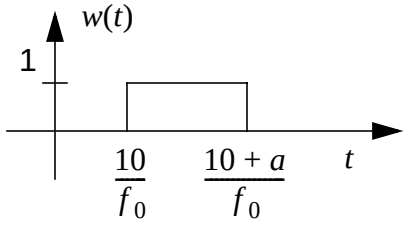


(a) Sketch the magnitude spectrum of $z(t) = x(t)y(t)$ for $a = 1.5$:

(b) Compare the result in part (a) to the result that woud be obtained if $w(t)$ is changed from a rectangular function to a triangle-shaped function:



(c) For $w(t)$ shown to the right, sketch the magnitude spectrum of $z(t) = x(t)w(t)$:



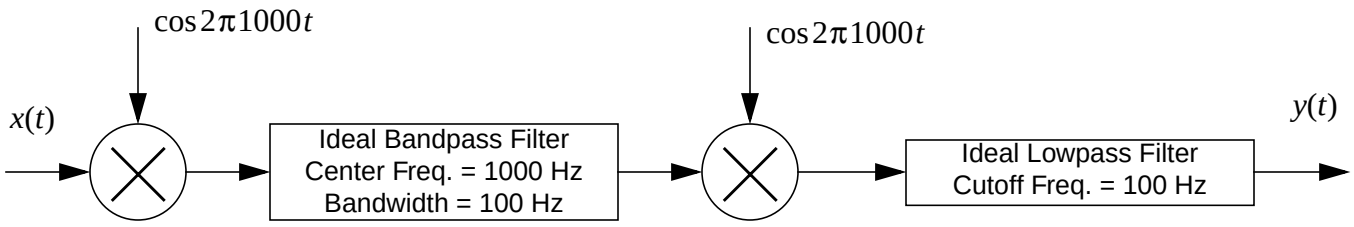
(d) Suppose $x(t)$ is given by:

$$x(t) = \sin 2\pi f_0 t + \sin 2\pi (f_0 + \varepsilon) t$$

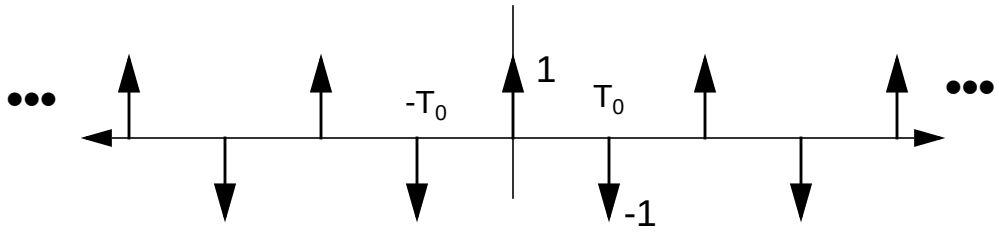
where $\varepsilon \ll f_0$. For $w(t)$ shown in part (a), sketch the magnitude spectrum and discuss the impact $w(t)$ has on the resulting spectrum. Compare this result to the spectrum of $x(t)$.

Problem No. 2:

(a) $x(t)$ is a data communications signal that has frequency content ranging from -50 Hz to 50 Hz. Compute $y(t)$ for the system shown below:

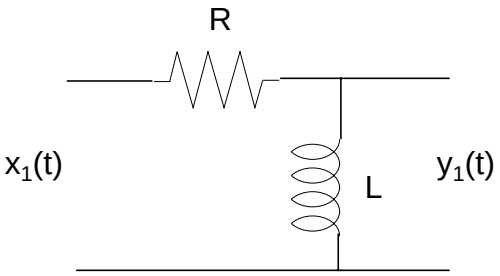


(b) Describe the shape of the magnitude spectrum of the impulse train shown below:

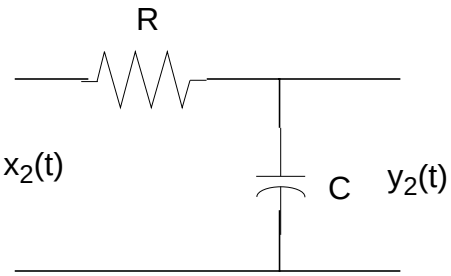


(c) Prove the time delay theorem for the Fourier Transform:

Problem No. 3:



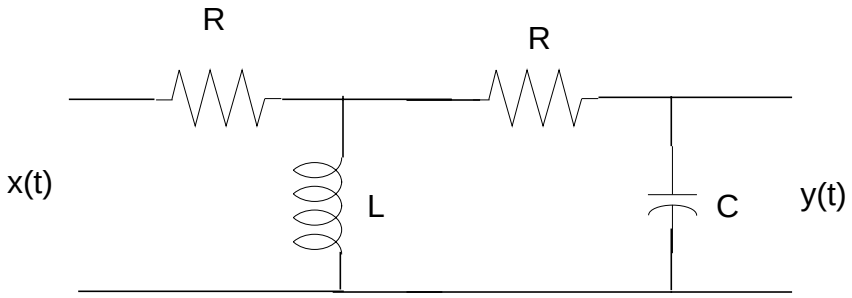
System H_1



System H_2

(a) Compute $H_1(s)$, $H_2(s)$, and $H_1(s)H_2(s)$. Assume all initial conditions are zero.

(b) Compute the transfer function H(s). Assume all initial conditions are zero.



(c) Explain the similarities and differences between the answers to (a) and (b). Are these systems linear?