EECS 360
Spring 2021
Analog Filtering

1. Let H(f) = tri(f/1000)
   a) Find the first zero bandwidth.
   b) Find the 3dB bandwidth.
   c) Find the equivalent rectangular bandwidth

2.
   a) $x(t)=10000\text{sinc}^2(10000t)$, x(t) is input to an ideal lowpass filter with a bandwidth of B kHz find the smallest B such that the filter introduces no distortion.
   b) Find the % energy in the frequency range $|f|\le 5000$?
   c) What are the barriers to building the filter described in part a)

3. Let $x(t)=\sum_{k=-\infty}^{\infty} rect(\frac{t-T_o k}{w})$ where w=.1μs and T_o=2μs
   Design (specify) a system (filter) to convert x(t) to $y(t)=\cos(2\pi f_a t)$ where f_a=1.5 MHz.

4. A series R, L, C circuit is modeled by the following differential equation with x(t)=input voltage and y(t)=output voltage=voltage across the capacitor.

$$LC\frac{d^2y(t)}{dt^2}+RC\frac{dy(t)}{dt}+y(t)=x(t)$$

   a) Find H(f).
   b) Plot $20Log_{10}(|H(f)|)$ with R=100 Ohm, L=0.001 Henry, C=0.000001 Farad. (You are encouraged to use Matlab to do this plot.)
   c) For R=100 Ohm, L=0.001 Henry, C=0.000001 Farad, given x(t)=cos(2π1760t) find A in y(t)=Acos(2π1760t+ϕ)
   d) Is 1760 Hz close to the 3 dB bandwidth for this system?
   Confirm your results with:
   http://www.ittc.ku.edu/~frost/EECS_360/Mathematica-360/Series-RLC-Transfer-Functions.cdf