Spring 2019 - Problem Set 5
ECE 301: Signals and Systems

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Due Date : April 5, 2019

Instructions

1. Please write clearly and legibly.
2. Your solutions must include detailed steps and/or explanations. Do not simply state the answer.
3. Write your full name (first,last), PUID on your homework submission.
4. All problems carry equal weight.

Problem 1

a What are the impulse response and the frequency response of the Ideal low pass filter?

b What are the practical limitations of an ideal low pass filter?

c Given an example of a low pass filter approximation. State both impulse and frequency responses.

Problem 2

a Find the Fourier transform of $\frac{\sin(4t)\sin(5t)}{t^2}$.

b Find the inverse Fourier transform of $\frac{\sin^2(4\omega)}{\omega^2}$.

Problem 3

Consider the modulation system shown below in figure 1. The input signal is $x(t)$ and has Fourier Transform $X(j\omega)$ that is zero for $|\omega| > \omega_M$ as shown in figure 2. The output of the system is $y(t)$. Sketch $Y(j\omega)$ which is the Fourier transform of $y(t)$. Show your work in detail and give explanations wherever necessary.

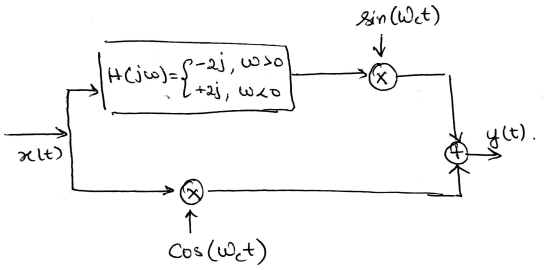

Figure 1: Caption

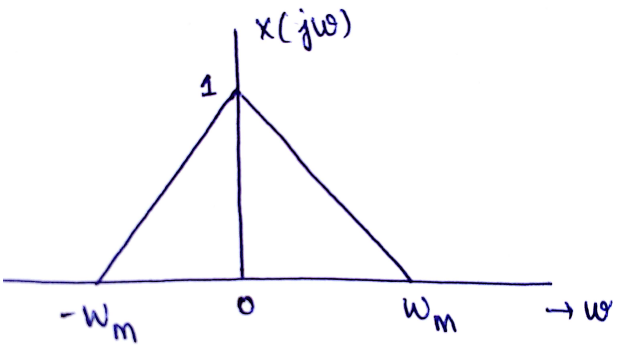

Figure 2: Caption

Problem 4

Derive the Convolution Property of the Fourier transform.

Problem 5

a What is the impulse response of a differentiator?

b What is the impulse response of an integrator?

c Find $\frac{\sin(\omega_0 t)}{\pi t} * \frac{\sin(2\omega_0 t)}{\pi t}$.

d Find the Fourier transform of $\frac{\sin(2t)\sin(t/4)}{\pi t^2}$.