Fall 2018 - Problem Set 3
ECE 301: Signals and Systems

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Due Date : October 12, 2018

Intructions

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 almost equal weight.

Problem 1

Find the solution to the following linear constant coefficient differential equation assuming initial rest.

$$\frac{dy(t)}{dt} + 4y(t) = x(t).$$
$$x(t) = 2e^{5t}u(t).$$

Problem 2

a If a periodic signal has finite energy, what does that imply on the convergence of its Fourier Series representation?

b State Dirichlet conditions. Give examples of periodic signals violating each condition. If a periodic signal satisfies all three conditions, what does that imply?

Problem 3

Compute the Fourier Series coefficients for the following periodic signals.

a $e^{-j\frac{3\pi t}{4}}$

b $\cos(3t) + 7j\sin(8t)$

c $(1 + 3\cos(\frac{\pi n}{4}))(\sin(\frac{3\pi n}{4} + \frac{\pi}{3}))$

d $1 + \sin(2\omega_0 t) + 3\cos(4\omega_0 t + \frac{\pi}{3})$

Problem 4

Compute the Fourier Series for the following periodic signals

a $x(t) = 5\cos(2\omega_0 t + \frac{\pi}{3})$

b $x[n] = \sum_{k=-\infty}^{\infty} \delta[n - 3k]$

c $x_1[n]$ in Figure 1.

d $x_1(t)$ in Figure 1.

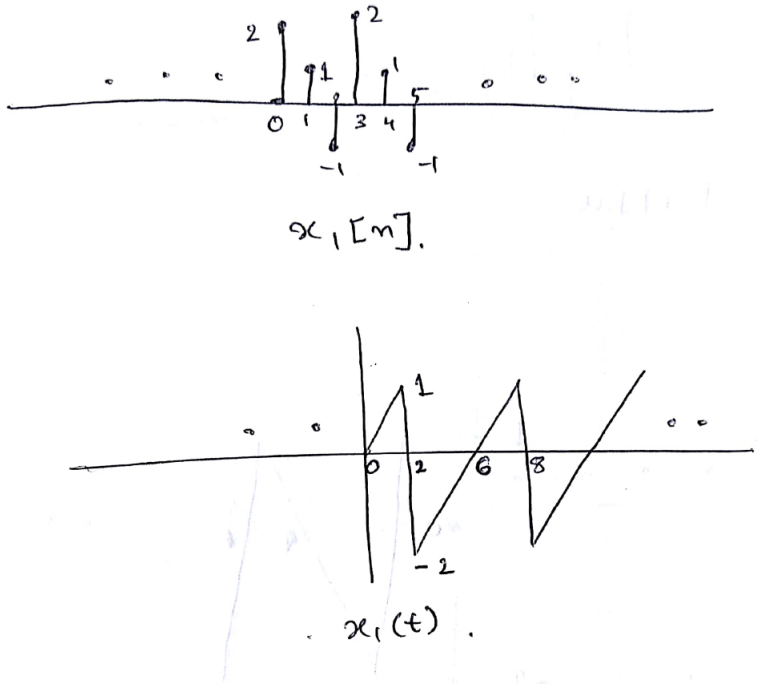

Figure 1

Problem 5

Consider the following signal x(t) with period T = 2

$$(t) = \begin{cases} 4t - 6, 0 \leq t \leq 1 \\ -2t, 1 \leq t \leq 2 \end{cases}$$

a Find the Fourier series representation of $\frac{dx(t)}{dt}$.

b Find the DC component of $\frac{dx(t)}{dt}$.

c Find the DC component of x(t).