Fall 2018 - Problem Set 1
# ECE 301: Signals and Systems

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**Due Date : September 14, 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.
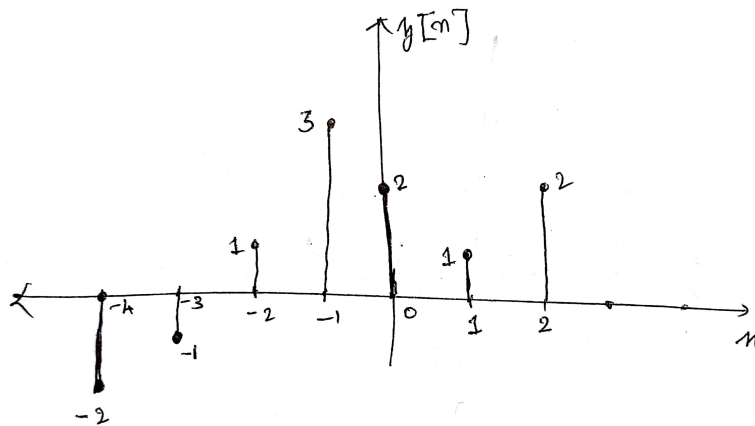4. All problems carry almost equal weight.

Problem 1: Even and Odd Signals.

a . Prove that the even function $x_e(t)$ is even. Prove that the odd function $x_o(t)$ is odd.

b . Determine if the following functions are odd or even

   i) $x[n] = n^2 + \cos(\frac{\pi}{2}|n|)$

   ii) $y(t) = \sin(\frac{3\pi}{4}t) + t^3$

c . For the signals in figure 1 sketch the even and odd parts.
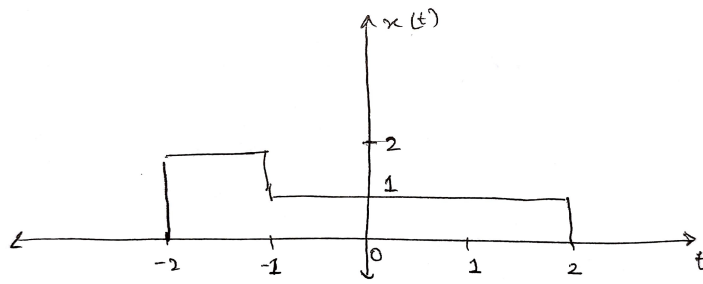
(a) x(t)
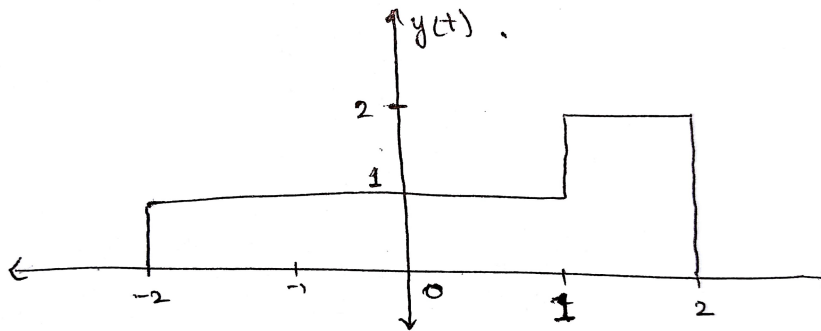
(b) y(t)

(c) z[n]

Figure 1: Problem 1

Problem 2 : Time transformations and unit impulse and step.
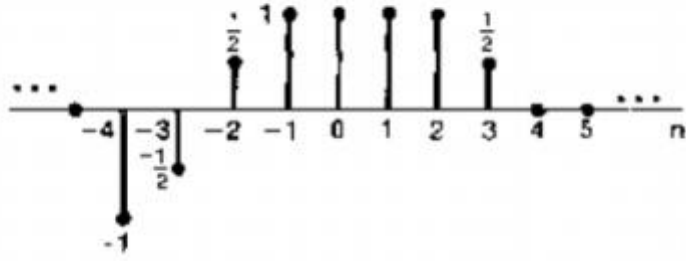
a . For $x[n]$ in figure 2(a) sketch
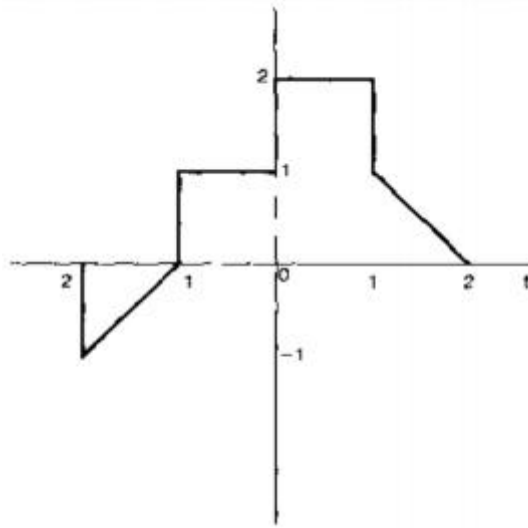
   i) $x[-\frac{n}{3}]u[n]$

   ii) $x[-2n+5]$

b . For $x(t)$ in figure 2(b) sketch

   i) $\sum_{n=-\infty}^{\infty} x(nT)\delta(t-nT)$ with $T=1$

   ii) $x(-\frac{t}{3}+2)u(-t)$

(a) x[n]

(b) x(t)

Figure 2: Problem 2

Problem 3 : Periodic and Aperiodic Signals.

For the following questions, determine if the signals are periodic or not. If periodic, find their fundamental period.

a . e^{5jt}

b . je^{5jt}

c . e^{5t}

d . e^{-5t}

e . $\cos(3\pi n^3) + e^{\frac{j10\pi n}{5}}$

f . $\cos(5\pi t) + \cos(5t)$

Problem 4. Invertibility.

Determine if each of the following systems is invertible. It it is, construct the inverse system. If it is not, find two input signals to the system that have same output.

    a . $y(t) = x(t+2)$

    b . $y(t) = \sin(2t)$

    c . $y[n] = \frac{1}{n}x[n]$

    d . $y(t) = \int_0^t x(t)\mathrm{dt}$

    e . $y[n] = x[n]x[n-5]$

Problem 5. Energy and Power.

Calculate E_∞ and P_∞ for the following

    a . $x[n] = \sin(\frac{\pi}{8}n)$

    b . $x(t) = e^{j(3t+\frac{\pi}{4})}$

    c . $x[n] = (\frac{1}{3})^n u[n]$

    d . $x[n] = j\sin(\frac{\pi}{6}n)$