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Amrita School of Computing

B. Tech CSE (AI) - 3rd semester 2022-2023 Odd semester

Assignment 1- Part 1

21AIE204 Introduction to Communication Systems Max. mark: 100

Objective/outcomes of the evaluation: As the fundamental understanding of electronic communication systems starts with the concept of signals & systems, this assignment (part 1) aims to test the understanding on elementary CT/DT/digital signals and some of their important properties. It is related to the following course outcomes:

- CO1: Understand basic Analog Communication Engineering
- CO2: Understand basic Digital Communication Techniques

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1. Express signum function using unit step function.

2. Find the value of the integral

   (a) $\int_0^{\infty} e^{t-2}\delta(3t-6)dt$. Hint: $\delta(at) = \frac{1}{|a|}\delta(t)$

   (b) $\int_{-1}^{2} (t+t^3)\delta(t+1)\ dt$

3. Determine whether the following signal is energy or power signals

   (a) $x(n) = 2^n u(n)$
   (b) $x(t) = e^{-t}u(t)$
   (c) $x(t) = t[u(t) - u(t-8)]$

4. Consider

   $x(t) = \delta(t+2) - \delta(t-3)$

   Find the energy of the signal y(t), where $y(t) = \int_{-\infty}^{\infty} x(\tau)d\tau$

5. a) Analyze the signal $x(t) = t\cos(t)$ for even or odd symmetry.
   b) Assume that $x_e[n] = 0.5^{|n|}$. Energy of x[n] is 5. Determine energy of $x_o[n]$.

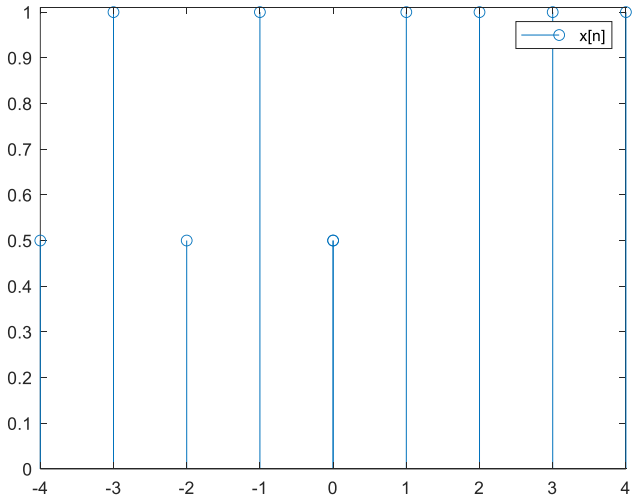
6. State whether the following signal is periodic or not. If yes, Find the fundamental period of the signal

   (a) $x(t) = \sin\frac{2\pi}{3}t\cos\frac{4\pi}{5}t$

   (b) $x(t) = je^{j10t}$

7. A signal $x(t) = 2\cos(150\pi t + 30^0)$ is sampled at 200 Hz. Find the time-period of the discrete signal. Hint: $t \to nT_s$ where $T_s = 1/f_s$.

8. For the following DT signal x[n], sketch the following. (Hint: downsample/upsample commands for scaling operation in discrete time)
   a) *Plot* $x[3n]$
   b) *Plot* $x[-3n]$
   c) *Plot* $x[-3n-6]$



9. Given $x[n] = 1 - \sum_{k=3}^{\infty}\delta[n-1-k]$. Find m and n0 such that $x[n] = u[mn - n0]$.

10. Given $y(t) = u(t+1) - u(t-2) + u(t-4)$. Find the value of the signal at different intervals in the range $-\infty$ *to* ∞. Plot the signal without using inbuilt command Heaviside.