

ECN-203: Signals & Systems (CSE)

Assignment 2

Due date: Thursday 17 September 2020

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September 8, 2020

1. Determine whether or not each of the following signals is periodic? If periodic, specify its fundamental period. (Marks: 2.5×4)
 - (a) $x_1(t) = 2je^{j12t}$
 - (b) $x_2[n] = e^{-0.7jn}$
 - (c) $x_3[n] = 3e^{\frac{j3\pi(n+\frac{1}{2})}{5}}$
 - (d) $x_4(t) = 5e^{j2\pi t}$
2. Determine fundamental period of the following signals: (Marks: 5×2)
 - (a) $x(t) = 2\cos(7t + 3) + 3\sin(3t + 4)$
 - (b) $x[n] = 1 + e^{\frac{j4\pi n}{7}} - e^{\frac{j2n}{5}}$
3. Write a small program (in programming language of your choice) to plot following signals (plot amplitude and phase separately). (Marks: 10×2)
 - (a) $x(t) = (2 + 3j)e^{(0.5+2j)t}$
 - (b) $x[n] = (2 + 3j)e^{(0.5+2j)n}$
4. Represent $x[n] = 1 - \sum_{k=-2}^{\infty} \delta[n-1-k]$ as shifted/scaled/time-reversed unit step function. (Marks: 5)
5. Considering $\delta(t)$ as the limiting function $\delta_{\Delta}(t)$ for $\Delta \rightarrow 0$, find the value of $\delta(2t)$. (Marks: 10)
6. Consider a system S with input $x[n]$ and output $y[n]$. This system is obtained through a series interconnection of a system $S1$ followed by a system $S2$. The input-output relationships for $S1$ and $S2$ are:
 $S1 : y_1[n] = 2x_1[n] + 4x_1[n-1]$ and $S2 : y_2[n] = x_2[n-2] + 0.5x_2[n-3]$ (Marks: 5×2)
 - (a) Determine input output relation of system S
 - (b) What is the input-output relationship of system S if the order in which $S1$ and $S2$ are connected in series is reversed (i.e., $S2$ followed by $S1$)

7. Consider a system whose input and output are related as: $y(t) = x(\sin(t))$. (Marks: 2×3)

(a) Is this system memoryless? Why or why not?

(b) Is this system causal? Why or why not?

(c) Is this system invertible? Why or why not?

8. Find the inverse of following systems: (Marks: 3×3)

(a) $y(t) = x(t - 4)$

(b) $y[n] = nx[n]$

(c) $y[n] = \begin{cases} x[n+1], & n \geq 0 \\ x[n], & n \leq -1 \end{cases}$