SNS COLLEGE OF ENGINEERING

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AN AUTONOMOUS INSTITUTION

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SIGNALS AND SYSTEMS

1. You have the signal $x(t) = e^{j2\pi f_1 t} + e^{j2\pi f_2 t}$, where f_1 and f_2 are distinct frequencies. Determine if $x(t)$ is periodic. If so, find its fundamental period.

2. Consider the signals $x_1(t) = e^{-t}$ and $x_2(t) = e^{-2t}$, both defined for $t \geq 0$. Determine whether the sum $x(t) = x_1(t) + x_2(t)$ is periodic or aperiodic.

3. You have a deterministic signal $x(t) = \sin(2\pi 50t)$ and a noise term $n(t)$ that is white Gaussian noise with zero mean and unit variance. The observed signal is $y(t) = x(t) + n(t)$. Is $y(t)$ deterministic or random? Explain why.

4. Consider a signal $x(t) = \cos(2\pi 5t) \cdot A(t)$, where $A(t)$ is a random variable uniformly distributed between -1 and 1. Determine if $x(t)$ is periodic. If not, explain why.

5. Given the signal $x(t) = \sin(2\pi 3t) + \cos(2\pi 5t)$, find its fundamental period and determine if it is periodic.

6. You are given two signals:

   - $x_1(t) = \sin(2\pi t) + \sin(4\pi t)$
   - $x_2(t) = e^{-t}$

   Determine whether each signal is periodic or aperiodic. If periodic, find the fundamental period.

7. Consider the following two signals:

   - $x_3(t) = \cos(2\pi 5t)$
   - $x_4(t)$ is a signal whose values are given by the random process $X(t)$ with $X(t) \sim \mathcal{N}(0, 1)$ at each time instant.

   Identify which signal is deterministic and which is random.

8. Suppose you have two signals:

- $x_5(t) = \cos(2\pi 3t)$
- $x_6(t) = \cos(2\pi 7t)$

Find the period of the resulting signal $x(t) = x_5(t) + x_6(t)$. Is the resulting signal periodic or aperiodic?

9. Consider a random signal $x(t)$ that is defined as $x(t) = A\sin(2\pi ft)$, where A is a random variable uniformly distributed between 0 and 1, and f is a fixed frequency. Describe the nature of the signal $x(t)$. Is it deterministic or random, and how does the randomness of A affect the signal?

10. Consider the signal $x(t) = \sin(2\pi(2t + t^2))$. Is this signal periodic? If so, find its period.