Unit 8 - Week 3: Duration and Bandwidth

Week 3 Assignment

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

1. Select the correct **statement(s)** with reference to the given signals:

   \[ x_1[k] = \begin{cases} 
   \sin(0.2\pi k) & \forall k \in \{0, 1, \ldots, 50\} \\
   \sin(0.3\pi k) & \forall k \in \{60, 61, \ldots, 119\} 
   \end{cases} \]

   \[ x_2[k] = \begin{cases} 
   \sin(0.3\pi k) & \forall k \in \{0, 1, \ldots, 50\} \\
   \sin(0.2\pi k) & \forall k \in \{60, 61, \ldots, 119\} 
   \end{cases} \]

   a. Both the signals are stationary.
   b. \( x_1[k] + x_2[k] \) is a stationary signal.
   c. The spectra of both the signals are identical.
   d. The spectra of both the signals are completely different.

   ![Answer Options](image)

   *No, the answer is incorrect.*

   **Score:** 0

   **Accepted Answers:**
   - b
   - c

2. Fourier transform is well suited to analyze

   a. Linear chirps
   b. Quadratic chirps
   c. Both linear and quadratic chirps
   d. None of the above

   ![Answer Options](image)

   *No, the answer is incorrect.*

   **Score:** 0

   **Accepted Answers:**
   - d
3. Which of the following statements concerning the bandwidth of the signal \( x(t) = \left( \frac{\alpha}{\pi} \right)^{\frac{1}{2}} e^{-\alpha(t-2)^2} e^{j\omega_0 t} \) are correct?

a. It has non-zero contributions from both amplitude & frequency modulation.

b. It has non-zero contribution only from amplitude modulation.

c. It has equal contributions from both amplitude & frequency modulation.

d. None of the above.

No, the answer is incorrect.
Score: 0
Accepted Answers:
d
4. Given \( 0 \leq \omega_2 \leq \omega_1 \), the analytic representation for the signal \( x(t) = \sin(\omega_1 t) \sin(\omega_2 t) \)

a. \( \cos(\omega_1 t) e^{j\omega_2 t} \)

b. \( \cos(\omega_2 t) e^{j\omega_1 t} \)

c. \( \sin(\omega_1 t) e^{j\omega_2 t} \)

d. \( \sin(\omega_2 t) e^{j\omega_1 t} \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
d
5. For a continuous-time signal \( x(t) \) which is a Gaussian amplitude modulated sine wave with frequency \( \omega_0 \):

a. The product of \( \langle t \rangle \) and \( \langle \omega \rangle \) is 0.

b. The value of \( \langle \dot{\omega}(t) \rangle \) is 0.

c. The value of \( \langle \dot{t}(t) \rangle \) is equal to \( \langle t \rangle \langle \omega \rangle \).

d. None of the above.

No, the answer is incorrect.
Score: 0
Accepted Answers:
c
Questions 7 to 11 are based on the following signal (Answers for these questions have to be reported as an integer):

\[ x(t) = \left( \frac{2}{\pi} \right)^{\frac{1}{4}} e^{-t^2+jt} \]

7. Suppose the duration of the given signal is denoted by \( \sigma_t \). The value of \( 6\sigma_t \) is

8. Suppose the bandwidth of the given signal is denoted by \( \sigma_\omega \). The value of \( \sigma_\omega^2 \) is

9. The instantaneous frequency of the signal is __ \( t + 1 \) rad/sec.

10. The value of \( \frac{B_{AM}}{B_{FM}} \) for the given signal is

11. If covariance of the signal is denoted by \( \sigma_{t\omega} \), the value of \( 10\sigma_{t\omega} \) is _____.

Questions 12 to 15 requires usage of the Time-Frequency Toolbox (ttfb) in MATLAB. A data is provided in the data file a3_signalData.mat. The time stamps of the signal are given vector (0:1:127).

(Round off the answers to these questions to one decimal place.)

12. The mean time for the given signal is
13. The center frequency for the given signal is ____ rad/sec.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 50.0

14. The bandwidth ($\sigma_w$) for the given signal is ____.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 0.9

15. The minimum value of instantaneous frequency observed for the given signal is ____ rad/sec.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) 0.3