Answers: 101 DCDE BDAC CCAD

ECE 3300 Spring 2016 (Signals, Systems, and Transforms): Exam 1

Record your name on this test; record your name, student ID, and test serial number on the scantron. Enter the test serial number in *COURSE*; you may leave *SECTION* blank. You must show your work on every problem, showing all steps on your test. Do not use scratch paper or write your work anywhere but on the test. Circle your answers on the test and bubble in the corresponding answers on your scantron. The examination lasts 50 minutes and you may use one sheet of notes (front and back); no old test questions can be on your notes. Calculator use is permitted. There is one correct answer per question. In problems asking to find coefficients A, B, C, etc., some of these coefficients may equal zero.

Question 1: Suppose $x(t) = (u(t+2) - u(t-2)) - \delta(t+1) - 2\delta(t) - \delta(t-3)$. Suppose $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$. Determine $y(1)$, $y(2)$, and $y(4)$. What is the sum of these three values? Choose the closest answer.
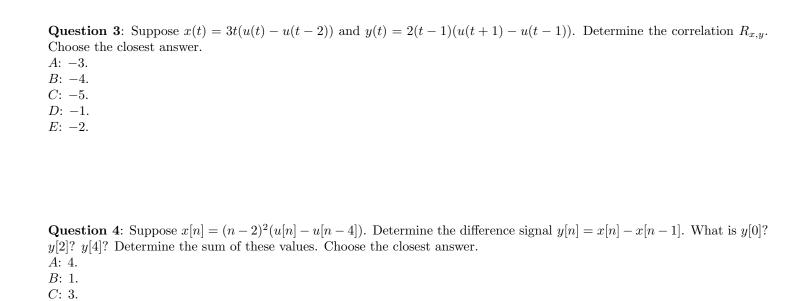A: 4.
B: 5.
C: 3.
D: 1.
E: 2.

Question 2: Suppose $x[n] = (n^2 + n)(u[n+2] - u[n-2])$ and $y[n] = 2x[n-1]$. What is $y[-1] + y[1] + y[3]$? Choose the closest answer.
A: 12.
B: 10.
C: 4.
D: 6.
E: 8.

Question 3: Suppose $x(t) = 3t(u(t) - u(t-2))$ and $y(t) = 2(t-1)(u(t+1) - u(t-1))$. Determine the correlation $R_{x,y}$. Choose the closest answer.

A: -3.

B: -4.

C: -5.

D: -1.

E: -2.

Question 4: Suppose $x[n] = (n-2)^2(u[n] - u[n-4])$. Determine the difference signal $y[n] = x[n] - x[n-1]$. What is $y[0]$? $y[2]$? $y[4]$? Determine the sum of these values. Choose the closest answer.

A: 4.

B: 1.

C: 3.

D: 0.

E: 2.

Question 5: Suppose the periodic signals $\tilde{x}[n]$ and $\tilde{y}[n]$ each have fundamental period $N_0 = 5$ and fundamental cycles $x[n]$ and $y[n]$. Suppose these fundamental cycles have energy $E_x = 5$ and $E_y = 6$ and correlation $R_{x,y} = 3$. Determine the mean-square error of the periodic signals, $\text{MSE}_{\tilde{x},\tilde{y}}$. Choose the closest answer.

A: 2.

B: 1.

C: 5.

D: 3.

E: 4.

Question 6: Suppose $x(t)$ has turn-on time $t = 1$ and turn-off time $t = 3$. Suppose $y(t) = x(t+3) + x(3t)$. What is the time duration of $y(t)$? Choose the closest answer. *Hint:* The time duration is the duration of time between turn-on and turn-off times; if the signal equals zero in intermediate points in time, the time duration is unaffected.

A: 5.

B: 7.

C: 11.

D: 3.

E: 9.

Question 7: Suppose $x(t) = 1$ if $0 < t \leq 1$, $2t$ if $1 < t \leq 2$, 0 if $t \leq 0$, and 2 if $t > 2$. Determine $y(t) = \frac{d}{dt}x(t)$. The answer has the form $A(u(t) - u(t-1)) + B(u(t-1) - u(t-2)) + C\delta(t) + D\delta(t-1) + E\delta(t-2)$. What is $A + B + C + D + E$? Choose the closest answer.

A: 2.
B: 1.
C: 0.
D: 3.
E: 4.

Question 8: Consider the complex-valued signal $x(t) = \frac{2}{2+e^{jt}}$. Determine $\text{Re}\{x(t)\}$. The answer can be written in the form $\frac{4 + A\cos(t)}{B + C\cos(t)}$. What is $A + B + C$? Choose the closest answer. *Hint:* Use $\text{Re}\{x(t)\} = \frac{1}{2}x(t) + \frac{1}{2}x^*(t)$ and put the result over a common denominator.

A: 3.
B: 7.
C: 11.
D: 9.
E: 5.

Question 9: Simplify $\sum\limits_{m=n-3}^{4} (\frac{1}{2})^m \delta[m+1]$. The answer has the form $Au[B + Cn]$, where $C = 1$ or -1. What is $A + B + C$? Choose the closest answer.

A: 7.
B: 6.
C: 3.
D: 5.
E: 4.

Question 10: Suppose $\tilde{x}(t)$ is periodic with fundamental period $T_0 = 2$ and fundamental cycle $x(t) = t^2(u(t+1) - u(t-1))$. Determine the power $P_{\tilde{x}}$. Choose the closest answer.

A: 0.6.
B: 1.0.
C: 0.2.
D: 0.8.
E: 0.4.

Question 11: Suppose $x(t) = (t+2)(u(t+1) - u(t-2))$. Determine $y(t) = \text{Ev}\{x(t)\}$. Let $y(1^+)$ denote the value of $y(t)$ just to the right of $t = 1$, and let $y(1^-)$ denote the value of $y(t)$ just to the left of $t = 1$. What is $y(1^+) + y(1^-)$? Choose the closest answer.

A: 3.5.
B: 1.5.
C: 2.5.
D: 5.5.
E: 4.5.

Question 12: Two signals with fundamental periods $T_1 = 4.84$ and $T_2 = 2.64$. If the sum of the signals has fundamental period $T = \text{LCM}(T_1, T_2)$, what is T? Choose the closest answer.

A: 12.
B: 24.
C: 18.
D: 30.
E: 6.