

Serial Number: **101**

Name:

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ECE 3300 FALL 2017 (SIGNALS, SYSTEMS, AND TRANSFORMS): EXAM 1

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. Write your letter answers in the bubbles next to each problem and on the first page. The examination lasts 60 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 $x(t) = t^2(u(t) - u(t-1)) + 2t(u(t-1) - u(t-2))$. The derivative signal $y(t) = \frac{d}{dt}x(t)$ has the form $2t(u(t) - u(t-1)) + 2(u(t-1) - u(t-2)) + A\delta(t) + B\delta(t-1) + C\delta(t-2)$. Determine $A + B + C$. Choose the closest answer.
- A: -4.
B: -3.
C: -5.
D: -2.
E: -1.

- ☐ **Question 2:** Suppose $x[n] = (n-1)(u[n-1] - u[n-5])$ and $y[n] = (n-2)(u[n-1] - u[n-5])$. Determine the correlation $R_{x,y}$. Choose the closest answer.
- A: 6.
B: 2.
C: 8.
D: 4.
E: 10.

- ☐ **Question 3:** Suppose $x(t) = -(u(t+1) - u(t-2)) + 2\delta(t-1) + u(t-3)$ and suppose $y(t) = \int_{-\infty}^t x(\tau)d\tau$. What is $y(0)$? $y(2)$? $y(4)$? Determine the sum of these three values. Choose the closest answer.
- A: -1.
B: 1.
C: -2.
D: 0.
E: 2.

☐ **Question 4:** Consider the aperiodic signal $x(t) = 2u(t) - u(-t)$. Determine the power. Choose the closest answer.

A: 0.00.
B: 5.00.
C: 3.75.
D: 2.50.
E: 1.25.

☐ **Question 5:** Suppose $\tilde{x}(t)$ is periodic with fundamental period $T_0 = 4$ and fundamental cycle $x(t) = 2\sqrt{t}$, $0 \leq t < 2$ and 0 otherwise. Determine the power $P_{\tilde{x}}$. Choose the closest answer.

A: 3.
B: 2.
C: 5.
D: 4.
E: 1.

☐ **Question 6:** Suppose $x(t) = 2(u(t+4) - u(t+2)) - 2(u(t+2) - u(t-2)) + 4(u(t-2) - u(t-6))$. Determine $y(t) = \text{Ev}\{x(t)\}$. What is $y(1)$? $y(3)$? $y(5)$? Determine the sum of these values. Choose the closest answer.

A: 1.
B: 4.
C: 2.
D: 5.
E: 3.

☐ **Question 7:** Suppose $x[n] = \delta[n] + 2\delta[n-1] - 2\delta[n-3]$. Determine the sum signal $y[n] = \sum_{m=-\infty}^n x[m]$. What is $y[1]$? $y[2]$? $y[3]$? Determine the sum of these values. Choose the closest answer.

A: 8.
B: 10.
C: 6.
D: 7.
E: 9.

☐ **Question 8:** Consider the complex-valued signal $x(t) = \frac{2+3jt}{1-jt}$. Determine $\text{Im}\{x(t)\}$. The answer can be written in the form $\frac{At}{1+t^2}j$. Determine A . Choose the closest answer.

A: 3.
 B: 5.
 C: 4.
 D: 2.
 E: 1.

☐ **Question 9:** Suppose $x[n] = 2^n(u[n+3] - u[n]) + 3(u[n-1] - u[n-4])$. If $y[n] = x[-1-n]$, determine the turn-on time for $y[n]$. Choose the closest answer.

A: -1.
 B: -3.
 C: -4.
 D: -2.
 E: -5.

☐ **Question 10:** Suppose $x(t) = (t+1)(u(t+3) - u(t-2))$. Let $y(t) = \frac{1}{2}x(2t)$. What is the sum of time duration and the maximum value of $y(t)$? Choose the closest answer.

A: 7.
 B: 4.
 C: 6.
 D: 5.
 E: 8.

☐ **Question 11:** Simplify $\sum_{m=-2}^{n-1} 2m2^{-m}\delta[m-2]$. The answer can be written in the form $Au[n-B]$. What is $A+B$? Choose the closest answer.

A: 2.
 B: 1.
 C: 3.
 D: 4.
 E: 5.

☐ **Question 12:** Let T_1 be the fundamental period of $\tilde{x}(t)$ and T_2 the fundamental period $\tilde{y}(t)$. The sum $\tilde{x}(t) + \tilde{y}(t)$ has fundamental period $T = \text{LCM}\{T_1, T_2\}$. Determine T if $T_1 = 2.8$ and $T_2 = 4.4$. The answer has the form $AB.C$, where each of A , B , and C are single digits. What is $A + B + C$? Choose the closest answer.

A: 11.

B: 13.

C: 15.

D: 7.

E: 9.
