

Answers: BCBD BEDE ADBB

Serial Number: **501**

Name:

ECE 3300 SPRING 2016 (SIGNALS, SYSTEMS, AND TRANSFORMS): EXAM V

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. The examination lasts 50 minutes and you may use five sheets 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 $X(z) = \frac{4z^{-3}}{(1 - z^{-1})(1 - 2z^{-1})}$ with ROC $|z| > 2$. It follows that $x[n] = A\delta[n] + B\delta[n - 1] + Cu[n] + D2^n u[n]$. What is A ? Choose the closest answer.

A: 5.

B: 3.

C: 4.

D: 2.

E: 1.

Question 2: Suppose $X(s) = \frac{1}{s+1} + \frac{1}{s-1} + \frac{1}{s^2+1}$. If the ROC is $-1 < \text{Re}\{s\} < 0$, determine $x(t)$. The answer has the form $Ae^{-t}u(Bt) + Ce^t u(Dt) + E \sin(t)u(Ft)$ where each of A through F are 1 or -1 . What is $A + B + C + D + E + F$? Choose the closest answer.

A: -4 .

B: 4.

C: -2 .

D: 0.

E: 2.

Question 3: Suppose $x(t) = 2tu(-t) + te^t u(-t) + te^{-t} u(t) + te^{2t} u(-t)$. Determine the ROC for $X(s)$.

A: $0 < \text{Re}\{s\} < 1$.

B: $-1 < \text{Re}\{s\} < 0$.

C: $-2 < \text{Re}\{s\} < 1$.

D: $1 < \text{Re}\{s\} < 2$.

E: $-2 < \text{Re}\{s\} < -1$.

Question 4: Suppose $X(s) = \frac{-2-s^3}{s(s+1)^2}$. The partial fraction expansion has the form $A + \frac{B}{s} + \frac{C}{s+1} + \frac{D}{(s+1)^2}$. Determine C . Choose the closest answer.

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

Question 5: Suppose $x[n]$ has Z transform $X(z) = \frac{2+z}{z^3-2z+8}$. Determine the Z transform of $(-\frac{1}{2})^n x[n]$. The answer has the form $\frac{1+Az}{B+Cz+Dz^2+Ez^3}$. What is $A+B+C+D+E$? Choose the closest answer. You do not need to determine an ROC in this problem.

- A: -1.
- B: 1.
- C: 0.
- D: -2.
- E: 2.

Question 6: Suppose $x[n]$ has Z transform $X(z)$ with ROC $|z| < 2$, $y[n] = x[-n]$, and $w[n] = \sum_{m=-\infty}^n y[m]$. Determine the ROC for the Z transform of $w[n]$.

- A: $|z| > 2$.
- B: $|z| < \frac{1}{2}$.
- C: $\frac{1}{2} < |z| < 1$.
- D: $1 < |z| < 2$.
- E: $|z| > 1$.

Question 7: Suppose $x(t) = e^{-2t}u(t) + e^{-t}u(-t)$. Which statement is correct?

- A: The Fourier transform exists but the Laplace transform does not.
- B: The Laplace and Fourier transforms exist but $X(j\omega)$ can not be found by substituting $s = j\omega$ in $X(s)$.
- C: Neither the Laplace transform nor the Fourier transform exists.
- D: The Laplace transform exists but the Fourier transform does not.
- E: The Laplace and Fourier transforms exist and $X(j\omega)$ can be found by substituting $s = j\omega$ in $X(s)$.

Question 8: Suppose the signal $x[n] = 3n^2(\frac{1}{3})^n u[n]$ has Z transform $X(z)$. Further suppose $Y(z) = (3z^{-2} - 1)X(z)$. Determine $y[n]$. What is $y[3]$? Choose the closest answer. *Hint:* Use properties. Do not determine $X(z)$ and $Y(z)$ but instead determine a formula for $y[n]$ in terms of $x[n]$.

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

Question 9: Suppose $x[n] = (-\sqrt{2})^n (\cos(\frac{\pi}{4}n) + \sin(\frac{\pi}{4}n))u[n]$. Determine $X(z)$. The answer has the form $\frac{1+Az^{-1}}{1+Bz^{-1}+Cz^{-2}}$. Determine $A + B + C$. Choose the closest answer. You do not need to determine the ROC.

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

Question 10: Suppose $X(s) = \frac{2s+3}{(s+2)^2+1}$ with ROC $\text{Re}\{s\} > -2$. Determine $x(t)$. The answer has the form $e^{-at}(A \cos(bt) + B \sin(bt))u(t)$ where $b > 0$. What is $A + B + a + b$? Choose the closest answer.

- A: 3.
- B: 6.
- C: 2.
- D: 4.
- E: 5.

Question 11: Suppose a signal $x(t)$ has Laplace transform $X(s) = \frac{s}{\sqrt{1+s^2}}$. Suppose $y(t) = 2tx(t)$. Determine $Y(s)$. What is $Y(0)$? Choose the closest answer. You do not need to determine the ROC.

- A: 1.
- B: -2.
- C: -1.
- D: 2.
- E: 0.

Question 12: Given that $t \cos(t)u(t)$ has Laplace transform $\frac{s^2-1}{(s^2+1)^2}$ with ROC $\text{Re}\{s\} > 0$ determine the inverse Laplace transform of $\frac{s(s^2-1)}{(s^2+1)^2}$ with ROC $\text{Re}\{s\} > 0$. The answer has the form $(A + Bt) \cos(t)u(t) + (C + Dt) \sin(t)u(t)$. Determine $A + B + C + D$. Choose the closest answer.

- A: 2.
 - B: 0.
 - C: 1.
 - D: -1.
 - E: -2.
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