Answers: EBEA DBBA DACA

Serial Number: **501** Name:

ECE 3300 Spring 2017 (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. Circle your answers on the test and bubble in the corresponding answers on your scantron. The examination lasts 60 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 $x(t) = e^t(e^t + e^{-t})^2 u(-t)$. Determine the ROC for $X(s)$. The answer has the form $\text{Re}\{s\} < A$. What is A? Choose the closest answer. *Hint:* First expand the square.
A: 1.
B: 5.
C: 3.
D: -3.
E: -1.

Question 2: Suppose $x[n]$ has Z transform $X(z) = \frac{1}{(1+z^{-2})^2}$ with ROC $|z| > 1$. Determine the Laplace transform of $2^n x[n]$ including the ROC. The transform has the form $\frac{A}{(1+Bz^{-2})^2}$ and the ROC has the form $|z| > C$. What is $A + B + C$? Choose the closest answer.
A: 6.
B: 7.
C: 10.
D: 8.
E: 9.

Question 3: Suppose $x(s)$ has Laplace transform $X(s)$ with ROC $-2 < \text{Re}\{s\} < 0$. Suppose $y(t) = x(-t) + e^t x(t)$. Determine the ROC for $y(t)$. The answer has the form $A < \text{Re}\{s\} < B$. What is $A + B$? Choose the closest answer.
A: 3.
B: 4.
C: 5.
D: 2.
E: 1.

Question 4: Suppose $X(s) = \frac{1}{s+2} + \frac{2}{s+1} + \frac{3}{s} + \frac{1}{s-1} + \frac{2}{s-2}$ with ROC $-1 < \mathrm{Re}\{s\} < 0$. Determine $x(t)$. The answer has the form $Ae^{-2t}u(Bt) + Ce^{-t}u(Dt) + Eu(Ft) + Ge^{t}u(Ht) + Ie^{2t}u(Jt)$, where B, D, F, H, and J are each ± 1. What is $A + B + C + D + E + F + G + H + I + J$? Choose the closest answer.
A: -4.
B: -5.
C: -1.
D: -3.
E: -2.

Question 5: Suppose $X(z) = \frac{2-3z^{-2}}{1+z^{-1}}$ with ROC $|z| > 1$. It follows that $x[n] = A\delta[n] + B\delta[n-1] + C(-1)^n u[n]$. Determine A. Choose the closest answer.
A: 4.
B: 5.
C: 1.
D: 3.
E: 2.

Question 6: The signal $x(t) = J_0(t)u(t)$ has Laplace transform $X(s) = \frac{1}{\sqrt{1+s^2}}$ with ROC $\mathrm{Re}\{s\} > 0$. (The signal is a Bessel function but you don't need to know anything about Bessel functions to solve this problem.) Suppose $y(t) = 100\int_{-\infty}^{t} x(\tau - 1)d\tau$. Determine $Y(s)$. What is $Y(2)$? Choose the closest answer. *Hint:* First find the Laplace transform of $x(t-1)$.
A: 2.
B: 3.
C: 4.
D: 1.
E: 5.

Question 7: Suppose $X(s) = \frac{2s+4}{s^2+6s+13}$ with ROC $\mathrm{Re}\{s\} > -3$. Determine $x(t)$. The answer has the form $e^{-At}(B\cos(Ct) + D\sin(Ct))u(t)$ where $C > 0$. What is $A + B + C + D$? Choose the closest answer.
A: 7.
B: 6.
C: 5.
D: 8.
E: 9.

Question 8: Suppose $X(s) = \frac{(s-1)^2}{(s+1)^2(s+2)^2}$ with ROC $\mathrm{Re}\{s\} > -1$. It follows that $x(t) = (A+Bt)e^{-t}u(t) + (C+Dt)e^{-2t}u(t)$. What is C? Choose the closest answer.
A: 12.
B: 16.
C: 8.
D: 20.
E: 4.

Question 9: Suppose $x[n] = (\frac{2}{3})^n \cos(\frac{\pi}{3}n)u[n]$. Determine $X(z)$. The answer has the form $\frac{A+Bz^{-1}}{1+Cz^{-1}+Dz^{-2}}$. Determine $A+B+C+D$. Choose the closest answer. You do not need to determine the ROC.
A: 0.1.
B: 0.3.
C: 0.7.
D: 0.5.
E: 0.9.

Question 10: Suppose $x(t) = te^t u(t) + e^{2t}u(-t) + u(t)$. Which statement is correct?
A: The Laplace transform exists but the Fourier transform does not.
B: The Fourier transform exists but the Laplace transform does not.
C: The Laplace and Fourier transforms exist and $X(j\omega)$ can be found by substituting $s = j\omega$ in $X(s)$.
D: Neither the Laplace transform nor the Fourier transform exists.
E: The Laplace and Fourier transforms exist but $X(j\omega)$ can not be found by substituting $s = j\omega$ in $X(s)$.

Question 11: Suppose the signal $x[n]$ has Z transform $X(z) = \frac{1}{1+2z^{-1}+5z^{-2}}$. Suppose $Y(z) = \frac{2+3z^{-1}}{1+2z^{-1}+5z^{-2}}$. Determine $y[n]$ as a function of $x[n]$. The answer has the form $Ax[n] + Bx[n+C]$. What is $A+B+C$? Choose the closest answer. You do not need to determine the ROC in this problem.
A: 2.
B: 1.
C: 4.
D: 3.
E: 5.

Question 12: Suppose a signal $x(t)$ has Laplace transform $X(s) = \frac{s}{\sqrt{s^2+1}}$. Suppose $y(t)] = tx(t)$. Determine $Y(s)$. The answer has the form $\frac{As+B}{(s^2+1)^C}$. What is $A+B+C$? Choose the closest answer. You do not need to determine the ROC.
A: 0.5.
B: 4.5.
C: 3.5.
D: 1.5.
E: 2.5.
