California State University, Sacramento
The College of Engineering and Computer Science

EEE 180 Signals & Systems

Final Exam

Spring 2023

Student Name: _____

1.[24 points] Select one correct answer for Each of the following questions. Each question below has only one correct answer.

(1). The signal y is defined by: $y = \int_0^\infty \delta(t)dt$,   then which answer

     below is correct?   _____

     A. y=1   B. $y = \infty$ C. y = u(t)

(2). The discrete-time signal $y=2\cos(1.5\,\pi\,k + \frac{\pi}{4})$ is periodic. Which N value

     below can be used as the period of y?   _____

     A. N=1   B.   N = 2   C. N = 4

(3). A bounded-input and bounded-output system is called a _____ system.

     A. Causal   B.   Stable   C. Linear

(4).   The continuous-time signal $y=2\cos(6\,\pi\,t + \frac{\pi}{4})$. When the sampling

     frequency is 10 Hz, will the aliasing problem show up?   _____

     A. Yes   B.   No

(5).   Two continuous time signals are: y1 = sin(t) and   y2= sin(t) / t.

     Are they even or odd signals?   _____

     A. y1: even, y2: even   C. y1: odd,   y2: even
     B. y1: even, y2: odd   D. y1: odd,   y2: odd

(6).   The unilateral Laplace transform of δ(t) is   _____

     D. 1   B. 0   C. $\pi/2$ D. None of above
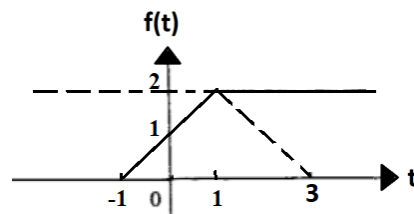
(7).   The system is governed by the following equation:
     dy(t) /dt + 3 y(t) + 2 = x(t) . Is this a linear system? _____
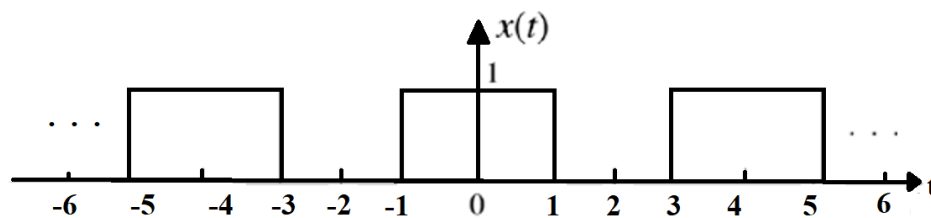
     A. Yes   B. No

(8).   The solid line below shows the waveform for f(t). What is the signal in the dashed line?   _____

f(t)

A. f(-t)   B.   f(-t + 2)   C. f(-t − 2)

2.[36 points]

(1). Find the Exponential Fourier Series of the following periodic signal with

a period of 4.

$x(t)$

(2).   Find the energy of the following signal:

$$x(t) = e^{-5t}u(t),$$

(3).   Find the Fourier Transform of the following signal:

$$x(t) = e^{-5t}u(t)$$

(4).   Find the z-transform of the sequence $x[n] = (0.2)^n u[n]$, and determine the region of convergence.

3. [40 points]

(1). Suppose the unilateral z-transform of f(t) is F(z), and the ROC is $|z| > 20$.

$$F(z) = \frac{z}{(z-10)(z-20)}$$. Find the f(t) signal equation.

The unilateral z-transform pair table is given below.

Unilateral z-transform Pair Table		
	$f[k]$	$F[z]$
1	$\delta[k-j]$	z^{-j}
2	$u[k]$	$\dfrac{z}{z-1}$
3	$ku[k]$	$\dfrac{z}{(z-1)^2}$
4	$k^2u[k]$	$\dfrac{z(z+1)}{(z-1)^3}$
5	$k^3u[k]$	$\dfrac{z(z^2+4z+1)}{(z-1)^4}$
6	$\gamma^{k-1}u[k-1]$	$\dfrac{1}{z-\gamma}$

(2).   The discrete time input signal $x[k] = \delta[k] + 2\delta[k-2] + 2\,\delta[k-3]$

The discrete time signal system impulse response signal

$$h[k] = u[k] - u[k - 2]$$

Draw the waveforms of x[k] and h[k].

(3).   For the above question (3), the system output response signal is defined as the convolution result of y[k] = x[k] * h[k].
Find the values of y[k].

(4).   For an LTIC system described by the transfer function
$$H(s) = \frac{s + 0.5}{s + 1}$$

Find the steady-state system response y(t) to the input signal of $f(t) = 2\,u(t)$.