Started on	Wednesday, 23 February 2022, 7:15 PM
State	Finished
Completed on	Wednesday, 23 February 2022, 8:00 PM
Time taken	44 mins 39 secs
Marks	9.50/30.00
Grade	**3.17** out of 10.00 (**32**%)

Question 1

Correct

Mark 1.00 out of 1.00

Let ***x(t)*** and ***y(t)*** denote the input and output of a continuous time system. Which of the following descriptions corresponds to a casual system ?

Select one:

a. $y(t) = (t+3)x(t+3)$

b. $y(t) = x(t-3) + x(t+2)$

c. $y(t) = (t+5)x(t-1)$ ✓

d. $y(t) = (t-4)x(t+1)$

Your answer is correct.

The correct answer is: $y(t) = (t+5)x(t-1)$

Question 2

Correct

Mark 1.00 out of 1.00

A cascade of 3 linear time invariant systems is causal and unstable. From this, we conclude that

Select one:

a. at least one system is causal and all systems are unstable.

b. the majority are unstable but the majority are causal.

c. each system in the cascade is individually causal and unstable.

d. at least one system is unstable and at least one system is causal. ✓

Your answer is correct.

The correct answer is: at least one system is unstable and at least one system is causal.

Question 3

Incorrect

Mark 0.00 out of 1.00

A system S has impulse response $h(t)$. The output of the system for $x(t)$ is given by $y(t)$. Consider the following statements:

$S1$: The output $y(t) = \int_{z=-\infty}^{\infty} x(z)h(t-z)dz$

$S2$: If $y(t) = 2x(t+3) - 0.5x(t-1)$, then $h(t) = 2\delta(t+3) - 0.5\delta(t-1)$

Which of the $S1, S2$ are correct:

Select one:

- a. None of $S1$ and $S2$
- b. Mark this if you don't want to attempt the question
- c. Only \(S2\)
- d. Only \(S1\)
- e. Both \(S1\) and \(S2\) ✗

S1 and S2 will be correct only when the system is LTI. As no information is given about the system, both S1 and S2 will be incorrect.

The correct answer is: None of \(S1\) and \(S2\)

Question 4

Correct

Mark 1.00 out of 1.00

Consider the following discrete time sequence:

x[n]={1,2,3,4,5,6,7(origin),6,5,4,3,2,1}

Evaluate **x[2n]** and **x[3n]**

Select one:

- a. **x[3n]={1,3,5,7(origin),5,3,1}** and **x[2n]={1,4,7(origin),4,1}**
- b. **x[2n]={2,5,6(origin),3,1}** and **x[3n]={2,4,6,6(origin),4,2,1}**
- c. **x[2n]={1,3,5,7(origin),5,3,1}** and **x[3n]={1,4,7(origin),4,1}** ✓
- d. **x[2n]={2,4,6,6(origin),4,2,1}** and **x[3n]={2,5,6(origin),3,1}**

Your answer is correct.

The correct answers are: **x[2n]={1,3,5,7(origin),5,3,1}** and **x[3n]={1,4,7(origin),4,1}**, **x[2n]={2,4,6,6(origin),4,2,1}** and **x[3n]={2,5,6(origin),3,1}**

Question 5

Correct

Mark 1.00 out of 1.00

A discrete LTI system has impulse response \(h[n] = a^n u[n] + b^n u[-n-1]\). This system is stable only if

Select one or more:

- a. \(|a| > 1, |b| > 1\)
- b. \(|a| > 1, |b| < 1\)
- c. \(|a| < 1, |b| > 1\) ✓
- d. \(|a| < 1, |b| < 1\)

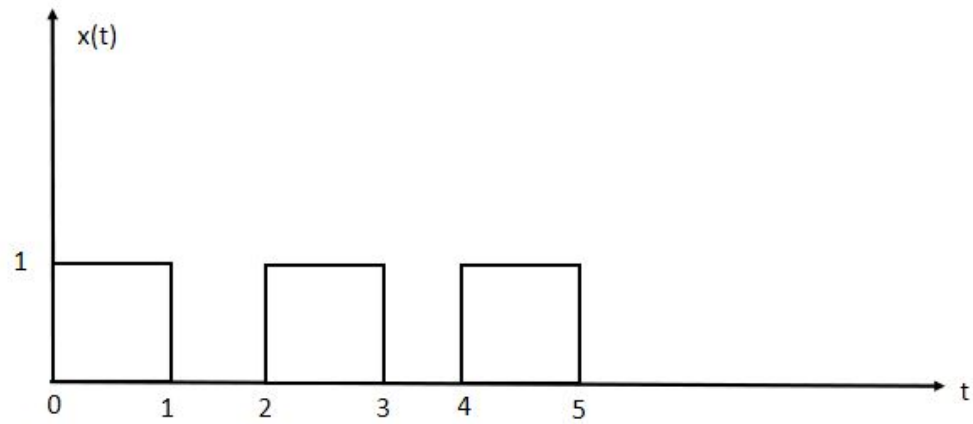
The correct answer is: \(|a| < 1, |b| > 1\)

Question 6

Correct

Mark 1.00 out of 1.00

The power of the signal \(x(t)\) upto second harmonic



Select one:

- a. 0.125 W
- b. 0.452 W ✓
- c. 0.525 W
- d. 0.252 W

Your answer is correct.

The correct answer is: 0.452 W

Question 7

Incorrect

Mark 0.00 out of 1.00

The Fourier Series coefficients of a periodic signal $x(t)$ expressed as $x(t)=\sum_{k=-\infty}^{\infty}a_k e^{j2\pi k t/T}$ are given by $a_{-2}=2-j1; a_{-1}=0.5+j0.2; a_{0}=j2;$ $a_{1}=0.5-j0.2; a_{2}=2+j1;$ and $a_{k}=0$; for $|k|>2$. Which of the following is true ?

Select one:

- a. $x(t)$ has finite energy because only finitely many coefficients are zero
- b. The imaginary part of $x(t)$ is constant
- c. $x(t)$ has zero average value because it is periodic.
- d. The real part of $x(t)$ is even ✗

Your answer is incorrect.

The correct answer is: The imaginary part of $x(t)$ is constant

Question 8

Correct

Mark 1.00 out of 1.00

Fundamental frequency of periodic signal $ e^\left(j \omega_o n \right) $ is given as (where m is integer and N is the period of the signal)

Select one:

- a. $ m(\frac{N}{2 \pi}) $
- b. $ N (\frac{2 \pi}{m}) $
- c. $ m (\frac{2 \pi}{N}) $ ✓
- d. None of these

Your answer is correct.

The correct answer is: $ m (\frac{2 \pi}{N}) $

Question 9

Correct

Mark 1.00 out of 1.00

Convolution of $x(t+4)$ with impulse function $\delta(t-8)$

is equal to

Select one:

- a. $x(t+12)$
- b. $x(t-12)$
- c. $x(t-4)$ ✓
- d. $x(t+4)$

Your answer is correct.

The correct answer is: $x(t-4)$

Question 10

Correct

Mark 1.00 out of 1.00

Two discrete time system with impulse response $h_1[n]=\delta[n-5]$ and $h_2[n]=\delta[n-7]$ are connected in cascade. The overall impulse response of the cascaded system is

Select one:

- a. $\delta[n-5]\delta[n-7]$
- b. $\delta[n-2]$
- c. $\delta[n-12]$ ✓
- d. $\delta[n-5]+\delta[n-7]$

Your answer is correct.

The correct answer is: $\delta[n-12]$

Question 11

Correct

Mark 1.00 out of 1.00

Consider the system with output response as $y[n] = \left(\frac {n+ 0.5}{n-0.5}\right)^2 x[n]$. Which of the following are true for this system?

Select one:

- a. Stable and linear ✓
- b. Not stable but linear
- c. Select this if you don't want to attempt
- d. Stable but non-linear
- e. Neither stable nor linear

Stability: $\left(\frac {n+ 0.5}{n-0.5}\right)^2$ has maximum value of 9 for n= 1. Hence, output is bounded for bounded input.

It is direct to prove that system is linear.

The correct answer is: Stable and linear

Question 12

Partially correct

Mark 0.50 out of 1.00

Consider a continuous time signal $x(t) = \left\{\begin{array}{rl}1, & 0 < t < 1\\ -2, & 1 < t < 2\end{array}\right.$. Now take $y(t) = \sum\limits_{k = -\infty}^{\infty}x(t - 2k)$. Then, which of the following is/are TRUE? (**All or nothing**)

- [x] The energy of y(t) is $\frac{5}{2}$ ✗
- [ ] The power of y(t) is $\frac{5}{2}$
- [ ] y(t) is aperiodic
- [ ] y(t) has a fundamental frequency of $2s^{-1}$

$y(t)$ is passed through a differentiator to obtain $h(t) = \frac{d}{dt}y(t)$. Now, $h(t)$ can be written as $h(t) = A\cdot p(t - T_1) + B\cdot p(t-T_2)$, where $p(t) = \sum\limits_{k = -\infty}^{\infty}\delta(t-2k)$, then which of the following is/are TRUE? (**All or nothing**)

- [x] $A = 3, \,T_1 = 0,\, B = -3, \,T_2 = 1$ ✓
- [ ] $A = 3, \,T_1 = 1,\, B = -3, \,T_2 = 0$
- [ ] $A = -3, \,T_1 = 0,\, B = 3, \,T_2 = 1$
- [ ] $A = -3, \,T_1 = 2,\, B = 3, \,T_2 = 0$

Your answer is partially correct.

1 of your answers is correct.

Question 13

Incorrect

Mark 0.00 out of 1.00

Let x(t) be a periodic signal whose Fourier series coefficients are $a_k = \begin{cases} 2, \quad &k=0 \\ j\left(\frac{1}{2}\right)^{|k|}, \quad &\text{otherwise} \end{cases}$.

Answer the below questions:

a) Is $x(t)$ real?

b) Is $x(t)$ even?

c) Is $dx(t)/dt$ even?

Yes-Y, No-N

Select one:

- a. NNN ✗
- b. YYY
- c. NYN
- d. YYN
- e. NYY

Your answer is incorrect.

The correct answer is: NYN

Question 14

Incorrect

Mark 0.00 out of 1.00

Let $x(t)$ be the input and $y(t)$ be the output of a continuous time system. Match the system properties with system relations

Properties:

1. Linear but not time-invariant
2. Time-invariant but not linear
3. Linear and time-invariant

Relations:

(a) $y(t) = t^2 x(t)$

(b) $y(t) = |x(t)|$

(c) $y(t) = x(t-5)$

Select one:

- a. (1 - c) , (2 - a) , (3 - b) ✗
- b. (1 - b) , (2 - a) , (3 - c)
- c. (1 - a) , (2 - b) , (3 - c)
- d. (1 - c) , (2 - b) , (3 - a)
- e. (1 - b) , (2 - c) , (3 - a)
- f. (1 - a) , (2 - c) , (3 - b)

Your answer is incorrect.

The correct answer is: (1 - a) , (2 - b) , (3 - c)

Question 15

Incorrect

Mark 0.00 out of 1.00

Evaluate the following integral, $I = \displaystyle\int\limits_{\frac{\pi}{6}}^{\frac{\pi}{3}} (\cos^2(3t) - \sin^2(2t))\cdot \delta\left(\frac{\pi}{2} - t\right)dt$

Answer: 0.5 ✗

The delta function is zero for all non-zero arguments. Also, when argument of delta function is zero, its integral is 1 at that point.

The correct answer is: 0.00

Question 16

Incorrect

Mark 0.00 out of 1.00

Let, $f(t)$ be an impulse train, given by $f(t) =\displaystyle \sum\limits_{k =-\infty}^{\infty} \delta(t-kT) $, then the fourier series coefficients in the expansion of $g(t) = f\left(t\right) + f\left(t+\frac{T}{2}\right)$:

Select one:

- a. $\frac{2}{jT} \sin\left(\frac{n\pi}{2}\right)$ ✗
- b. $\frac{2}{T}$
- c. 0
- d. $\frac{2j}{T} \cos\left(\frac{n\pi}{2}\right)$

$g(t) = \sum\limits_{k=-\infty}^{\infty}\delta\left(t- \frac{kT}{2}\right)$

$a_k = \frac{2}{T}$

The correct answer is: $\frac{2}{T}$

Question 17

Incorrect

Mark 0.00 out of 1.00

Given $y(t) = \displaystyle\int\limits_{(t-10)}^{t} \cos (a)x(a) da $ and $x(t) \leq M \,\,\,\forall\,\, t$. Which of the following is/are correct for this system?

Select one or more:

- a. Not time-invariant but stable
- b. Stable and non-causal ✗
- c. Time invariant and causal
- d. Time-Invariant and Stable

Stability: $cos(a) \leq 1 $. So, $y(t) \leq 10M $

Time Invariance: $y(t - t_0) = \int_{(t - t_0 -10)}^{(t - t_0)} cos(a)x(a) da $ $= \int_{(t-10)}^{(t)} cos(a - t_0)x(a- t_0) da $. Hence, not time invarinat.

Causal: System is causal because only previous values of x(t) are needed.

The correct answer is: Not time-invariant but stable

Question 18

Incorrect

Mark 0.00 out of 1.00

The output $y[n]$ of a discrete time system is given by $y[n] = \text{sgn}[4n + 3]\cdot x[n]$, where

$\text{sgn}[n] = \left\{\begin{array}{rl}1, & n > 0\\ 0, & n = 0\\ -1, & n < 0 \end{array}\right.$

The inverse of the above system can be given by

Select one or more:

- [x] a. $y[n] = \text{sgn}[3n + 3]\cdot x[n]$
- [ ] b. The system is non-invertible.
- [ ] c. $y[n] = \text{sgn}[5n + 3]\cdot x[n]$
- [ ] d. $y[n] = \text{sgn}[6n + 3]\cdot x[n]$

The correct answers are: $y[n] = \text{sgn}[5n + 3]\cdot x[n]$
, $y[n] = \text{sgn}[6n + 3]\cdot x[n]$

Question 19

Incorrect

Mark 0.00 out of 1.00

Let $x(t)$ be a real continuous time signal. The even part of the signal $x(t)$ is $x_{e}(t)$ and the odd part is $x_{o}(t)$. Which of the following statements are true?

$S_{1}: \int_{-\infty}^\infty |x(t)|^2 dt = \int_{-\infty}^\infty |x_{e}(t)|^2 dt + \int_{-\infty}^\infty |x_{o}(t)|^2 dt$

$S_{2}: \int_{-\infty}^\infty x_{o}(t) dt = 0$

$S_{3}: \int_{-\infty}^\infty x_{e}(t) x_{o}(t) dt = 0$

Select one:

- ( ) a. S_2 and S_3 only
- ( ) b. S_1 and S_2 only
- ( ) c. S_1, S_2, and S_3
- (•) d. S_1 and S_3 only

Your answer is incorrect.

The correct answer is: S_1, S_2, and S_3

Question 20

Incorrect

Mark 0.00 out of 1.00

There are 2 systems. The outputs of the systems $y_{1}(t)$ and $y_{2}(t)$ for a given input $x(t)$ is defined by:

$\displaystyle y_{1}(t) = \int\limits_{-\infty}^{t} x(\tau)d\tau$

$\displaystyle y_{2}(t) = \int\limits_{-\infty}^{t} x(-\tau)d\tau$

The impulse responses of the systems are respectively:

- [x] $u(t), -u(t)$ ✗
- [ ] $-u(t), u(-t)$
- [ ] $u(t), u(-t)$
- [ ] $u(t), u(t)$

The step responses of the systems are respectively:

- [ ] $tu(t), tu(t)$
- [x] $tu(t), -tu(t)$ ✗
- [ ] $-tu(t), -\infty$
- [ ] $tu(t), \infty$

Your answer is incorrect.

Question 21

Incorrect

Mark 0.00 out of 1.00

What is the output of a system with impulse response $h[n] = (\frac{1}{2})^n u[n]$ for input $x[n] = 3 + \cos(\pi n + \frac{\pi}{3})$?

Select one:

- a. $y[n] = 1 + \frac{2}{3}\sin(\pi n + \frac{\pi}{3})$
- b. $y[n] = 3 + \frac{2}{3}\sin(\pi n + \frac{\pi}{3})$ ✗
- c. $y[n] = 6 + \frac{2}{3}\cos(\pi n + \frac{\pi}{3})$
- d. $y[n] = 3 + \frac{1}{3}\cos(\pi n + \frac{\pi}{3})$

The correct answer is: $y[n] = 6 + \frac{2}{3}\cos(\pi n + \frac{\pi}{3})$

Question 22

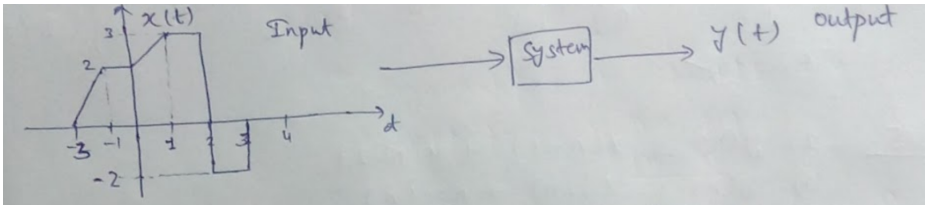
Incorrect

Mark 0.00 out of 1.00

Consider a signal x(t) as shown below. This signal is passed through a system which gives output \(y(t)\). The system response is given by

\(y(t) = x\left(\frac{-t}{3} + 2\right)\).

Find the value of \(y(12)\).



Answer: 3 ✗

Put value if \(t\) in argument of input signal and compute the time at which input signal value is needed.

The correct answer is: 1.00

Question 23

Incorrect

Mark 0.00 out of 1.00

If a signal \(x(t)\) has fourier series coefficients as \(a_{k}\), what will be the fourier series coefficients of \(x(2t)\), \(x(-t)\) and \(x*(t)\) respectively?

Select one:

- a. \(a_{k},a_{-k},a_{k}\)
- b. \(a_{k},a_{-k},a*_{-k}\)
- c. \(a_{2k},a_{-k},a*_{k}\) ✗
- d. \(a_{\frac{k}{2}},a_{-k},a*_{k}\)

The correct answer is: \(a_{k},a_{-k},a*_{-k}\)

Question 24

Incorrect

Mark 0.00 out of 1.00

Which of the following represents an invertible system?

Select one:

- a. $y(t)= \sin(x(t))$
- b. $y[n]=x[n]x[n-1]$ ✗
- c. $y(t)=x(t-3)$
- d. $y(t)=x^2(t)$

Your answer is incorrect.

The correct answer is: $y(t)=x(t-3)$

Question 25

Incorrect

Mark 0.00 out of 1.00

Which of the following signals have same average power

$x_1(t)= 20\sin(3 \pi t)\\ x_2(t) = 20\sin(6 \pi (t-2/3)) \\ x_3(t)= 2\cos(6 \pi t+\pi/2)\\ x_4(t)= 10\cos(3\pi (t-2/3))+10 \cos(4\pi t)$

Select one:

- a. $x_2(t) \text{ and } x_4(t)$ ✗
- b. $x_1(t) \text{ and } x_2(t)$
- c. $x_1(t), x_2(t), \text{ and } x_4(t)$
- d. $x_1(t) \text{ and } x_4(t)$

Your answer is incorrect.

The correct answer is: $x_1(t) \text{ and } x_2(t)$

Question 26

Incorrect

Mark 0.00 out of 1.00

Statement 1 (1): Memoryless systems are non-causal.

Statement 2 (2): For a causal system, the output is dependent only on the past values of the input.

Select one:

- a. Select this option if you don't want to mark the answer
- b. Both (1) and (2) are FALSE
- c. (1) is TRUE and (2) is TRUE and (2) is NOT the correct explanation for (1) ✗
- d. (1) is TRUE and (2) is FALSE
- e. (1) is TRUE and (2) is TRUE and (2) is the correct explanation for (1)
- f. (1) is FALSE and (2) is TRUE

Memoryless systems do not require any past values, hence they are causal.

The correct answer is: Both (1) and (2) are FALSE

Question 27

Incorrect

Mark 0.00 out of 1.00

A LTI system is defined by its impulse response \(h[n] = \left(\frac{1}{2}\right)^nu[n-2]\). The system is:

Select one:

- a. Stable but not causal ✗
- b. Select this if you don't want to attempt
- c. Causal but not stable
- d. Unstable and not causal
- e. Stable and Causal

The correct answer is: Stable and Causal

Question 28

Incorrect

Mark 0.00 out of 1.00

The impulse response $h(t)$ of a linear time invariant continuous time system is described by

$h(t) = e^{\alpha t} u(t) + e^{\beta t} u(-t)$ where $u(t)$ denotes the unit step function.

α and β are real constants.

This system is stable if

Select one:

- a. α is positive and β is negative
- b. α is positive and β is positive ✗
- c. α is negative and β is negative
- d. α is negative and β is positive

Your answer is incorrect.

The correct answer is: α is negative and β is positive

Question 29

Incorrect

Mark 0.00 out of 1.00

Let $x(t)$ be a signal with Energy E, then the energy of $cx(at- b)$ can be expressed as $|a|^{k_1}|b|^{k_2}|c|^{k_3}E$, where k_1, k_2, k_2 are all integers. Find the value of $k_1 + 2k_2 + 3k_3$.

Answer: 9 ✗

Energy of $cx(at- b)$ = $\frac{c^2E}{|a|}$. So, $k_1 = -1, k_2 = 0$ and $k_3 = 2$.

The correct answer is: 5

Question 30

Incorrect

Mark 0.00 out of 1.00

The fundamental period of the continuous time signal $x(t) = |\sin(13\pi t)| + |\cos(13\pi t)|$ is given by

Select one:

- a. 0.077 ✗
- b. 0.038
- c. 2pi
- d. None
- e. 0.15

Your answer is incorrect.

Drawing rough sketch of $|\sin(13\pi t)| + |\cos(13\pi t)|$ gives answer quickly!

The correct answer is: 0.038

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Jump to...

Part A ►