Started on	Saturday, 4 November 2023, 9:30 AM
State	Finished
Completed on	Saturday, 4 November 2023, 10:30 AM
Time taken	59 mins 48 secs
Grade	**9.00** out of 15.00 (**60**%)

Question 1

Correct

Mark 1.00 out of 1.00

Consider a casual LTI system characterized by the difference equation $y[n] - \frac{1}{2}y[n-1] + \frac{1}{18}y[n-2] = 3x[n]$.

The value of impulse response $h[n]$ at $n = 1$ is

Select one:

- 3.5
- 0
- 3
- 5
- 2
- 1/2
- 3/2 ✓

Your answer is correct.

The correct answer is: 3/2

Question 2

Incorrect

Mark 0.00 out of 1.00

The sequence $x[n] = 0.5^n u[n]$ where $u[n]$ is the unit step sequence, is convolved with itself to obtain $y[n]$. Then $\sum_{n=-\infty}^{+\infty}(-1)^n y[n]$ is

Answer: 4 ✗

The correct answer is: 0.44444

Question 3

Correct

Mark 1.00 out of 1.00

If the DTFT of $y[n]$ is related to the DTFT of $x[n]$ as $Y(e^{j\omega}) = X(e^{j\omega}) - 2j\frac{d}{d\omega}X(e^{j\omega}) - \frac{d^2}{d\omega^2}X(e^{j\omega})$, then $y[n]$ is related to $x[n]$ as

Select one:

- $n^2x[n-1]$
- $(n-1)^2x[n]$ ✓
- $(n-2)x[n]$
- $(n+1)^2x[n]$
- $-(n-1)^2x[n]$
- $(n-1)x[n]$
- None of the other options are correct

Your answer is correct.

The correct answer is: $(n-1)^2x[n]$

Question 4

Correct

Mark 2.00 out of 2.00

The integral $\int_{-\pi}^{\pi} \frac{1}{|1-0.5e^{-j\omega}|^4} d\omega$ has a value

Select one:

- None of the above ✓
- 2π
- 0.25π
- π

Your answer is correct.

The correct answer is: None of the above

Question 5

Correct

Mark 1.00 out of 1.00

Let an input $x[n]$ having discrete time fourier transform $X(e^{j\omega}) = 1 - e^{-j\omega} + 2e^{-3j\omega}$ be passed through an LTI system. The frequency response of the LTI system is $H(e^{j\omega}) = 1 - \frac{1}{2}e^{-j2\omega}$. The output $y[n]$ of the system is

Select one:

- $\delta[n] + \delta[n-1] - \frac{1}{4}\delta[n-2] - \frac{5}{2}\delta[n-4] + \delta[n-5]$
- $\delta[n] - \delta[n-1] - \frac{1}{2}\delta[n-2] - \frac{5}{2}\delta[n-3] + \delta[n-5]$
- $\delta[n] + \delta[n-1] + \frac{1}{2}\delta[n-2] + \frac{5}{2}\delta[n-3] + \delta[n-5]$
- $\delta[n] + \delta[n-1] - \frac{1}{2}\delta[n-2] - \frac{5}{2}\delta[n-3] + \delta[n-5]$
- $\delta[n] - \delta[n-1] - \frac{1}{2}\delta[n-2] + \frac{5}{2}\delta[n-3] - \delta[n-5]$ ✓
- None of the other options are correct

Your answer is correct

The correct answer is: $\delta[n] - \delta[n-1] - \frac{1}{2}\delta[n-2] + \frac{5}{2}\delta[n-3] - \delta[n-5]$

Question 6

Incorrect

Mark 0.00 out of 1.00

Consider the signal $x[n] = 6\delta[n+2] + 3\delta[n+1] + 8\delta[n] + 7\delta[n-1] + 4\delta[n-2]$. If $X(e^{j\omega})$ is the DTFt of $x[n]$, then $\frac{1}{\pi}\int_{-\pi}^{\pi} X(e^{j\omega})\sin^2(2\omega)d\omega$ is equal to

Answer: 4 ✗

The correct answer is: 8

Question 7

Correct

Mark 1.00 out of 1.00

Let $h[n]$ denote impulse response of an LTI system such that $h[0] = 1/5$; $h[1] = 2/5$; $h[2] = 1/5$ and $h[n] = 0$ otherwise.

If $H(\omega)$ denotes the DTFT of $h[n]$ and $H(\omega_0) = 0$ for one value of ω between 0 and π, then the value of ω_0 is

Select one:

- 0
- π ✓
- $\frac{\pi}{2}$
- None of the other answers are correct

Your answer is correct.

The correct answers are: π

, None of the other answers are correct

Question 8

Incorrect

Mark 0.00 out of 1.00

Let $h[n] = 0.5^n u[n]$. Denote its Fourier transform by $H(e^{j\omega})$. One student who did not know how to implement an LTI system with infinite-length impulse response decided to truncate the impulse response to 3 coefficients (that is, he ignored all impulse response coefficients for $n \geq 3$) and then implement the LTI system. Denote the truncated impulse response by $\hat{h}[n]$ and its Fourier transform by $\hat{H}(e^{j\omega})$. The value of $\frac{1}{2\pi}\int_{-\pi}^{\pi} \left|H(e^{j\omega}) - \hat{H}(e^{j\omega})\right|^2 d\omega$ is

Answer: 0.25 ✗

The correct answer is: 0.02083

Question 9

Correct

Mark 1.00 out of 1.00

The discrete-time Fourier transform $X\left(e^{j\omega}\right)$ of a sequence $x[n]$ is of the form:

$$X(e^{j\omega}) = \begin{cases} 1 & -\pi < \omega \leq -0.75\pi \\ 1 & 0.75\pi \leq \omega \leq \pi \\ 0 & Otherwise \end{cases}$$

$Y(e^{j\omega})$ is the perodic convolution of $X(e^{j\omega})$ with itself. Then $y[n]$ is

Select one:

- None of the other options are correct
- $2\pi\left(\frac{\sin(0.5\pi n)}{\pi n}\right)^2$
- $\left(\frac{\sin(0.5\pi n)}{\pi n}\right)^2$
- $\frac{\sin(0.5\pi n)}{\pi n}$
- $\left(\frac{\sin(0.75\pi n)}{\pi n}\right)^2$
- $\frac{\sin(0.25\pi n)}{\pi n}$
- $\frac{\sin(0.75\pi n)}{\pi n}$
- $2\pi\left(\frac{\sin(0.25\pi n)}{\pi n}\right)^2$

Your answer is correct.

The correct answer is: $2\pi\left(\frac{\sin(0.25\pi n)}{\pi n}\right)^2$

Question 10

Correct

Mark 1.00 out of 1.00

It is desired to find a three-tap causal filter that gives zero signal as an output to an input of the form

$x[n] = c_1 e^{-\frac{j\pi n}{2}} + c_2 e^{\frac{j\pi n}{2}}$ where c_1 and c_2 are arbitrary real numbers.

The desired three-tap filter is given by

$h[n] = 1, a, b$ where origin at 1. What are the values of the filter taps a and b if the output is $y[n] = 0$ for all n

Select one:

- None of the other choices are correct
- $a = -1$ and $b = 1$
- $a = 0$ and $b = 2$
- $a = 0$ and $b = 1$ ✓
- $a = 2$ and $b = 0$
- $a = 1$ and $b = 1$
- $a = 0$ and $b = -1$

Your answer is correct.

The correct answer is: $a = 0$ and $b = 1$

Question 11

Incorrect

Mark 0.00 out of 2.00

If $x[n] = \frac{1}{\pi^2} \sum_{m=1}^{\infty} \frac{1}{m(n-m)}$ then $x[n] =$

Select one:

- $-0.25\delta[n]$ ✗
- None of the above
- π
- $0.25\delta[n]$
- $\delta[n]$
- n

Your answer is incorrect.

The correct answer is: None of the above

Question 12

Correct

Mark 1.00 out of 1.00

It is claimed that $(-\omega + 2\pi)^7 e^{-j\omega/2}, 0 \leq \omega \leq 4\pi,$ is a valid discrete-time Fourier transform of a sequence $x[n]$. Is this statement true or False?

Select one:

- True
- False ✓

The correct answer is 'False'.

Question 13

Incorrect

Mark 0.00 out of 1.00

The Fourier transform of a signal $x[n]$ is given by

$$X(e^{j\omega}) = \frac{e^{j\frac{\omega}{2}}}{2j} \frac{\sin(\frac{3}{2}\omega)}{\sin^2(\frac{\omega}{2})} + 5\pi\delta(\omega), \quad -\pi < \omega \leq \pi.$$

The value of $x[3]$ is

Answer: 2 ✗

The correct answer is: 4

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