

SIGNALS & SYSTEMS

QUIZ

1) An LTI system has impulse response $h(t) = u(t-1)$.
If the input is $x(t) = u(t-2)$, then the output $y(t)$ is _____

2) Which of the following system is not stable?

(i) $h(n) = \left(\frac{1}{2}\right)^n u(n) + \left(\frac{2}{3}\right)^n u(n+1)$

(ii) $h(n) = \left(\frac{2}{3}\right)^n u(-n)$

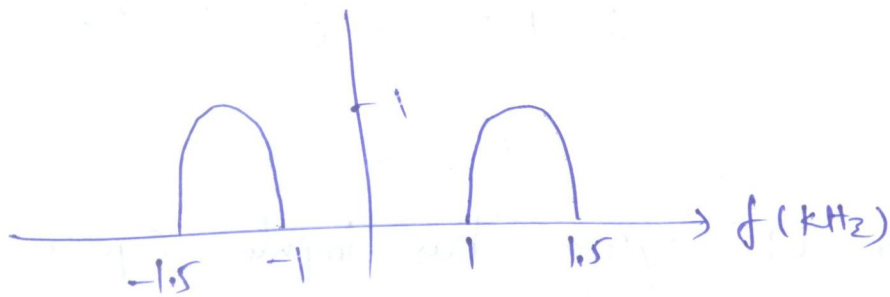
(iii) $h(n) = (-3)^n u(-n)$

(iv) $h(n) = n u(n) - n u(n-10)$

3) Two LTI systems with impulse response $h_1[n] = \delta[n]$ and $h_2[n] = \delta[n] - \delta[n-2]$ are connected in series.
If the input is $x[n] = u[n]$ then the output is _____

4) An LTI system with impulse response $h(t) = \frac{1}{\sqrt{t+2}} u(t+1)$.
Check whether Causal and stable?

5) An Analog signal has the spectrum shown in below figure. The minimum sampling rate needed to completely represent this signal is _____



6. Let $x[n] = \{3, 4, 5, 6\}$, then $x[2n-1]$ is —
7. Let $x(t)$ be a signal for which $X(\omega) = 0$ for $|\omega| > \omega_m$. Another signal $y(t)$ is having Fourier transform $Y(\omega) = 2X(\omega - \omega_c)$. If $x(t) = m(t)y(t)$ then the signal $m(t)$ is —
8. The maximum amplitude of cross-correlated sequence of $x[n] = \{2, 5, 0, 4\}$ and $h[n] = \{3, 1, 4\}$ is —
9. A system with input $x(t)$ and output $y(t)$ can be described by $\dot{w}(t) = y(t) + x(t)$ & $\dot{y}(t) = -w(t)$. The impulse response of this system is —
10. Consider a LTI system whose unit sample response is
- $$h(n) = \begin{cases} \left(\frac{1}{2}\right)^{n/2}; & n = 0, 2, 4, \dots \\ 0, & \text{elsewhere} \end{cases}$$
- Then the poles of its transfer function are located at —

11. If the impulse response of the LTI system is $h(t) = e^{-t}$, then the corresponding differential equation is _____

12. What is the inverse Laplace transform of

$$X(s) = \log \left(\frac{s(s+1)}{s^2+1} \right)$$

13. What are the initial and final values of

$$X(s) = \frac{3s+2}{s(s^2+3s+2)}, \text{ respectively.}$$

14. The DFT of a sequence

$$x(n) = [A, 2, 3, 4, 5, 6, 7, B] \text{ is } X(k)$$

If $X(0) = 20$, $X(4) = 0$, then find the value of

$$2A - B.$$

15. Two filters described by

$$y(n) = 0.4y(n-1) + x(n) \quad \text{and} \quad h_2(n) = 2(0.4)^n u(n).$$

Then find the transfer function of the parallel combination of above two systems.

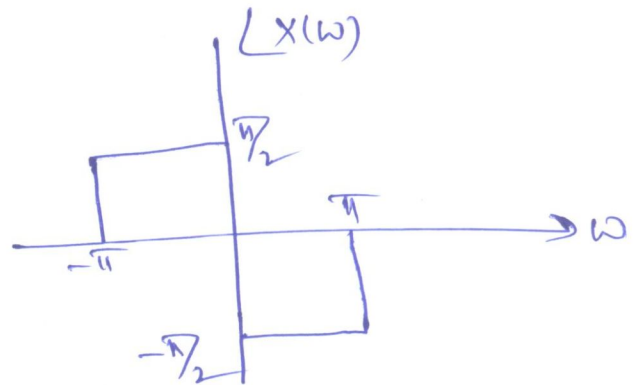
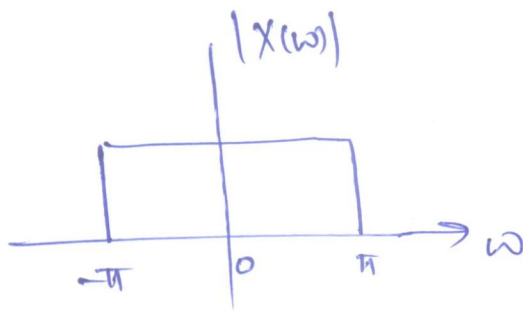
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CLASS TEST

1. What is the Exponential Fourier Series Coefficients of $x(t) = \cos^2(4t) + \sin^2(2t)$.

2. The magnitude and phase spectrum of a signal $x(t)$ shown in figure. Then the value of $x(t)$ at $t = \frac{1}{2}$

is _____



3. Let $x(e^{j\omega}) = 4 - 2e^{-j2\omega}$. If $y(n) = x(n-2)$, then what is the value of $y(e^{j\omega})$ at $\omega = \pi$.

4. Let $F(z) = 2 + 5z^{-1} - 4z^{-2}$. Find the z -transform of $x(n) = f(-n)$ and its ROC.

5. The DFT of a sequence $x(n) = \{2, -1, 4, 3\}$ is $X(k) = \{\alpha, \beta, \gamma, \delta\}$. Then what is the value of

$$\frac{\alpha + \beta}{2}$$

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ASSIGNMENT

1. What percentage of total energy in the signal $f(t) = e^{-t} u(t)$ is contained in the frequency band $|\omega| \leq 7$ rad/sec?
2. The convolution of $\text{sinc}(t)$ with $\text{sinc}^2(t/2)$ is —
3. What is the inverse Fourier transform of $X(\omega) = e^{-|\omega|/2}$.
4. The frequency response of the system is $H(e^{j\omega}) = 4 - 2e^{-2j\omega}$. If the input is $x(n) = 4\delta(n) + 2\delta(n-2)$. If the output of the system is $y(n)$. Then find $y(4n)$.
5. An FIR system with input $x(n]$ and output $y(n]$ are related as $y(n) = 0.2x(n) - 0.5x(n-2) + 0.4x(n-3)$. If the applied input is $\{-1, 1, 0, -1\}$ then the output at $n=2$ is —