CLASS TEST

S.No.: 01DLSK_IJK_15072026

MADE EASY
Leading Institute for IES, GATE & PSUs

Delhi | **Bhopal** | **Hyderabad** | **Jaipur** | **Pune**

Web: www.madeeasy.in | **E-mail:** info@madeeasy.in | **Ph:** 011-45124612

SIGNAL & SYSTEM

EC-EE

Date of Test : 15/07/2026

ANSWER KEY

1.	(d)	7.	(d)	13.	(b)	19.	(b)	25.	(b)
2.	(b)	8.	(c)	14.	(a)	20.	(d)	26.	(d)
3.	(a)	9.	(d)	15.	(c)	21.	(a)	27.	(d)
4.	(c)	10.	(a)	16.	(d)	22.	(a)	28.	(b)
5.	(c)	11.	(b)	17.	(b)	23.	(d)	29.	(b)
6.	(d)	12.	(b)	18.	(a)	24.	(c)	30.	(c)

DETAILED EXPLANATIONS

1. (d)

$$2^n\, u[n] \overset{z}{\longleftrightarrow} \frac{1}{1-2z^{-1}}$$

$\therefore$ $$\text{ROC} \Rightarrow |z| > 2$$

and $$(4)^n\, u[-n-1] \overset{z}{\longleftrightarrow} \frac{1}{1-4z^{-1}}$$

$\therefore$ $$\text{ROC} \Rightarrow |z| < 4$$

$\therefore$ for the signal to converge

$$\text{ROC} \Rightarrow 2 < |z| < 4$$

2. (b)

$$y[n] = x[n] * \delta[n-2] = x[n-2]$$

$\therefore$ $$y[2] = x[0] = 1$$

3. (a)

$$Re\,\{x(t)\} = \frac{x(t)+x^*(t)}{2}$$

$\therefore$ The Fourier coefficient of $x^*(t)$ are

$$b_K = \frac{1}{T}\int_T x^*(t)e^{-jK\frac{2\pi}{T}t}\,dt$$

Taking conjugate on both sides

$$b_K^* = \frac{1}{T}\int_T x(t)e^{-j(-K)\frac{2\pi}{T}t}\,dt$$

$\therefore$ $$a_{-K} = b_K^*$$

$\therefore$ Fourier series Coefficient of $Re\,\{x\,(t)\} = \dfrac{a_K + a_{-K}^*}{2}$

4. (c)

From the given figure of $x(t)$ and $y(t)$, we get conclude that,

$$x(0) = y(5)$$

at $t = 5$ sec, $$y(5) = x(-5a+20) = x(0)$$

$\therefore$ $$-5a + 20 = 0$$

$\therefore$ $$a = 4$$

5. (c)

We know that the Laplace transform of

$$\cos(at)u(t) = \frac{s}{s^2+a^2}$$

$$\therefore \quad \cos(\pi t)u(t) = \frac{s}{s^2+\pi^2}$$

now, the given function $x(t)$ can be written as,

$$= \cos\pi t[u(t) - u(t-1)]$$
$$= \cos(\pi t)u(t) - \cos\pi t\, u(t-1)$$
$$= \cos\pi t u(t) - \cos\pi(t-1+1)u(t-1)$$
$$= \cos\pi t u(t) - \cos[\pi(t-1)+\pi]u(t-1)$$
$$x(t) = \cos(\pi t)u(t) + \cos[\pi(t-1)]u(t-1)$$

By taking Laplace transform,

$$X(s) = \frac{s}{s^2+\pi^2} + \frac{s e^{-s}}{s^2+\pi^2} \qquad [\because x(t-t_0) = X(s)\cdot e^{-st_0}, \text{ by shifting property}]$$

$$X(s) = \frac{s[1+e^{-s}]}{s^2+\pi^2}$$

6. (d)

Let us consider two signals,

$$x_1(t) = 1, \quad \forall\, t$$

$$x_2(t) = -1, \quad \forall\, t$$

Clearly $x_1(t) \neq x_2(t)$ but $(x_1(t))^2 = (x_2(t))^2$

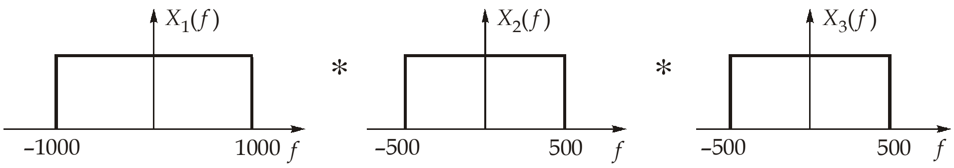
Therefore different inputs gives the same output hence the system is non invertible.

And also it is non linear system.

7. (d)

We know that,

For $\quad X(f) = X_1(f) * X_2(f) * X_3(f)$



Sampling frequency, $\quad f_s = 2(1000 + 500 + 500)$

$$f_s = 4000 \text{ samples/sec}$$

8. (c)

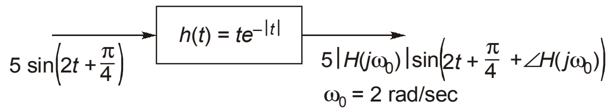
Conjugate anti-symmetric part of $x[n]$ is $\dfrac{x[n]-x^*[-n]}{2}$.

$$x^*[-n] = [2,\ 1+j,\ -2+j5]$$

$$\therefore \quad \frac{x[n]-x^*[-n]}{2} = \frac{[-2-j5, 1-j, 2]-[2,(1+j),-2+j5]}{2} = [-2-j2.5, \underset{\uparrow}{-j}, 2-j2.5]$$

© Copyright: MADE EASY

9. (d)



$$h(t) = te^{-|t|}$$

$$H(j\omega) = j\frac{d}{d\omega}\left(\frac{2}{1+\omega^2}\right) = \frac{-4j\omega}{(1+\omega^2)^2}$$

$$|H(j\omega_0)| = \left|\frac{-4j(2)}{(1+4)^2}\right| = \frac{8}{25} \qquad (\omega_0 = 2 \text{ rad/sec})$$

$$\angle H(j\omega_0) = -90°$$

$$\text{output} = 5\times\frac{8}{25}\sin\left(2t+\frac{\pi}{4}-\frac{\pi}{2}\right) = \frac{8}{5}\sin\left(2t-\frac{\pi}{4}\right)$$

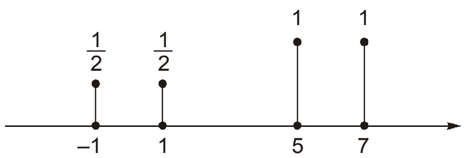
$$= \frac{8}{5}\left(\frac{\sin 2t}{\sqrt{2}}-\frac{\cos 2t}{\sqrt{2}}\right)$$

$$= \frac{8}{5\sqrt{2}}(\sin 2t-\cos 2t)$$

$$= 1.13\ (\sin 2t - \cos 2t)$$

10. (a)

$x[n+1] =$



$$x[2n+1] = 0$$

$\Rightarrow$ $$n\,x[2n+1] = y[n] = 0$$

$\Rightarrow$ $$\sum_{n=-\infty}^{\infty} y[n] = 0$$

11. (b)

$$Y(e^{j\omega}) = X(e^{j\omega}) * X(e^{j\omega-\pi/2})$$

$\therefore$ In time domain

$$Y(e^{j\omega}) = 2\pi x_1[n]\cdot x_2[n]$$

now, If $$X(e^{j\omega}) \longleftrightarrow n\left(\frac{3}{4}\right)^{|n|}$$

Then $$X(e^{j\omega-\pi/2}) \longleftrightarrow n\cdot e^{j\pi/2}\left(\frac{3}{4}\right)^{|n|}$$

$\therefore \qquad y[n] \longleftrightarrow 2\pi n^2 e^{j\pi n/2}\left(\frac{3}{4}\right)^{2|n|}$

12. (b)

$$X(z) = \frac{z}{z-1} \qquad |z| > 1$$

$$Y(z) = \frac{2z}{z-\frac{1}{3}} \qquad |z| > \frac{1}{3}$$

$$H(z) = \frac{2(z-1)}{z-\frac{1}{3}} \qquad |z| > \frac{1}{3}$$

$$X'(z) = \frac{z}{z-\frac{1}{2}} \qquad |z| > \frac{1}{2}$$

$$Y'(z) = \mathrm{H(z)} \cdot X'(z)$$

$$= \frac{2z(z-1)}{\left(z-\frac{1}{2}\right)\left(z-\frac{1}{3}\right)} \qquad |z| > \frac{1}{2}$$

Taking inverse z transform

$$y[n] = \left[-6\left(\frac{1}{2}\right)^n + 8\left(\frac{1}{3}\right)^n\right]u[n]$$

$k_1 = -6, \quad k_2 = 8$

so, $\qquad k_1 + k_2 = 2$

13. (b)

If $x[n]$ is real

$$\text{odd}[x[n]] \xrightarrow{FT} jIm[X(e^{j\omega})]$$

$$\therefore \qquad \text{odd}[x[n]] = F^{-1}\left[\frac{1}{2}\left(e^{j\omega} - e^{-j\omega} - e^{2j\omega} + e^{-2j\omega}\right)\right]$$

$$= \frac{1}{2}[\delta[n+1] - \delta[n-1] - \delta[n+2] + \delta[n-2]]$$

$$\because \qquad \text{odd } [x[n]] = \frac{x[n] - x[-n]}{2}$$

Since, $\qquad x[n] = 0$ for $n > 0$

$$x[n] = 2\ \text{odd}[x[n]]$$

$$= \delta[n+1] - \delta[n+2] \text{ for } n < 0$$

using parshevel's theorem

© Copyright: MADE EASY

$$\frac{1}{2\pi}\int_{-\infty}^{\infty}\left|X\left(e^{j\omega}\right)\right|^2 d\omega = \sum_{n=-\infty}^{\infty}|x[n]|^2$$

$$(x[0])^2 - 2 = 3$$

$$x[0] = \pm 1$$

$\because$ $$x[0] > 0$$

$\therefore$ $$x[n] = \delta[n] + \delta[n+1] - \delta[n+2]$$

14. (a)

$$x[n] = \delta[n]$$

$$X(e^{j\omega}) = 1$$

$$\frac{dX(e^{j\omega})}{d\omega} = 0$$

$\therefore$ $$Y(e^{j\omega}) = e^{-j\omega}\, X(e^{j\omega})$$

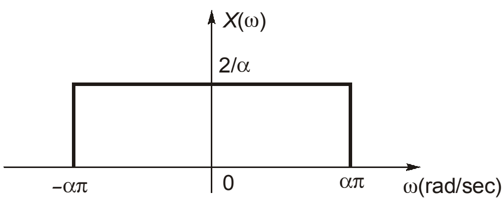
$$h[n] = \frac{1}{2\pi}\int_{-\pi}^{\pi} e^{-j\omega}.e^{j\omega n}d\omega = \frac{\sin\pi(n-1)}{\pi(n-1)}$$

15. (c)

We know that,

Energy, $$E = \int_{-\infty}^{\infty} x^2(t)\,dt = \frac{1}{2\pi}\int_{-\infty}^{\infty}|X(\omega)|^2\,d\omega$$

Now, $X(\omega) =$



$$E = \frac{1}{2\pi}\int_{-\alpha\pi}^{\alpha\pi}\left|\frac{2}{\alpha}\right|^2 d\omega$$

$$0.5 = \frac{1}{2\pi}\times\frac{4}{\alpha^2}[2\alpha\pi]$$

$$0.5 = \frac{4}{\alpha}$$

$\therefore$ $$\alpha = 8$$

16. (d)

Given, $$x[n] = \cos\frac{\pi}{4}n + \sin\left(\frac{\pi}{3}n + \frac{1}{2}\right)$$

Let $$x[n] = x_1[n] + x_2[n]$$

Let N_1 be the period of $x_1[n]$.

$$\frac{\pi/4}{2\pi} = \frac{m}{N_1}$$

$\Rightarrow$ $$N_1 = 8$$

Let N_2 be the period of $x_2[n]$.

$$\frac{\pi/3}{2\pi} = \frac{m}{N_2}$$

$\Rightarrow$ $N_2 = 6$

Overall time period, $N = \text{LCM}(N_1, N_2) = \text{LCM}(6, 8)$

$\therefore$ $N = 24$

17. (b)

Given, $$X(z) = \frac{1}{1-2.5z^{-1}+z^{-2}} = \frac{1}{(z^{-1}-2)\left(z^{-1}-\frac{1}{2}\right)}$$

$$\frac{1}{(z^{-1}-2)\left(z^{-1}-\frac{1}{2}\right)} = \frac{A}{z^{-1}-2}+\frac{B}{z^{-1}-\frac{1}{2}}$$

$\therefore$ $$A = \frac{1}{2-\frac{1}{2}} = \frac{1}{3/2} = \frac{2}{3}$$

$$B = \frac{1}{\frac{1}{2}-2} = -\frac{2}{3}$$

$\therefore$ $$X(z) = \frac{\frac{2}{3}}{z^{-1}-2}+\frac{-\frac{2}{3}}{z^{-1}-\frac{1}{2}}$$

$$= \frac{-\frac{1}{3}}{1-\frac{1}{2}z^{-1}}+\frac{\frac{4}{3}}{1-2z^{-1}}$$

Given $X(z)$ is a causal system, the ROC is right of the right most pole.

$\therefore |z|>2$

hence, $$x[n] = -\frac{1}{3}\left(\frac{1}{2}\right)^n u[n]+\frac{4}{3}(2)^n u[n]$$

$\therefore$ $$x(0) = -\frac{1}{3}+\frac{4}{3} = \frac{3}{3} = 1$$

18. (a)

Given, $$X(e^{j\omega}) = \frac{\sin\frac{3\omega}{2}}{\sin\frac{\omega}{2}} = \frac{e^{j3\omega/2}-e^{-j3\omega/2}}{e^{j\omega/2}-e^{-j\omega/2}} = \frac{e^{j3\omega/2}\left[1-e^{-j3\omega}\right]}{e^{j\omega/2}\left[1-e^{-j\omega}\right]}$$

$$= e^{j\omega}\left[\frac{1-e^{-j3\omega}}{1-e^{-j\omega}}\right]$$

© Copyright: MADE EASY

$$X(e^{j\omega}) = \frac{e^{j\omega}}{1-e^{-j\omega}} - \frac{e^{-j2\omega}}{1-e^{-j\omega}}$$

by taking inverse DTFT,

$$x[n] = u[n+1] - u[n-2]$$

$$= \begin{cases} 1\,; & -1 \le n < 2 \\ 0\,; & \text{otherwise} \end{cases}$$

From parseval's theorem,

$$\sum_{n=-\infty}^{\infty} |nx[n]|^2 = \frac{1}{2\pi}\int_{-\pi}^{\pi}\left|\left[\frac{d}{d\omega}X(e^{j\omega})\right]\right|^2 d\omega$$

$$\therefore \quad \frac{1}{\pi}\int_{-\pi}^{\pi}\left|\left[\frac{d}{d\omega}X(e^{j\omega})\right]\right|^2 d\omega = 2\sum_{n=-\infty}^{\infty}|nx[n]|^2\, d\omega$$

$$= 2\sum_{n=-1}^{1}|n|^2 = 2[1+0+1] = 4$$

$$\frac{1}{\pi}\int_{-\pi}^{\pi}\left|\left[\frac{d}{d\omega}X(e^{j\omega})\right]\right|^2 d\omega = 4$$

19. (b)

$$X[k] = \sum_{n=0}^{N-1} x[n]e^{-j\frac{2\pi}{N}nK}$$

$$g[n] = x[n-2]_{\text{mod N}}$$

$$G[k] = e^{-j\frac{2\pi}{N}(2)k}X[k]$$

$$G[1] = e^{-j\frac{2\pi}{4}(2)1}X[1] = e^{-j\pi}X[1]$$

$$G[1] = -X[1] = -7$$

20. (d)

Given pole-zero plot can be written as,

$$X(z) = \frac{(z-1)(z+1)}{z^2} = \frac{z^2-1}{z^2} = 1 - z^{-2}$$

put $z = e^{j\omega}$,

$$|X(e^{j\omega})| = |1 - \cos 2\omega + j\sin 2\omega|$$

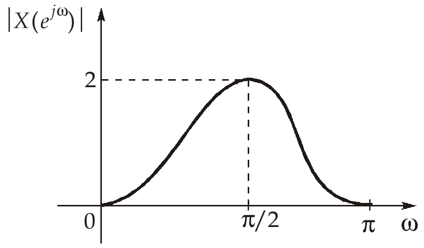
$$|X(e^{j\omega})| = \left|\sqrt{2-2\cos 2\omega}\right|$$

put, $\omega = 0 \Rightarrow \quad \left|X(e^{j\omega})\right| = 0$

$\omega = \pi/2 \quad \Rightarrow \quad \left|X(e^{j\pi/2})\right| = 2$

$$\omega = \pi \quad \Rightarrow \quad |X(e^{j\pi})| = 0$$

It is a bandpass filter response,



If poles are moved towards $\pm\dfrac{\pi}{2}$

Suppose we take poles are at $z = \pm j0.5$

$$X(z) = \frac{(z+1)(z-1)}{(z+j0.5)(z-j0.5)}$$

still response will remain same as BPF.
Because of zeros at the same position.

21. **(a)**

By the definition of Fourier series,

We can write $C_{N_0/2}$ for N_0 is even,

$$C_{N_0/2} = \frac{1}{N_0}\sum_{n=0}^{N-1} x[n]\, e^{-j\left(\frac{N_0}{2}\right)\left(\frac{2\pi}{N_0}\right)n}$$

$$= \frac{1}{N_0}\sum_{n=0}^{N-1} x[n]\, e^{-j\pi n} = \frac{1}{N_0}\sum_{n=0}^{N-1} (-1)^n x[n] = \text{real}$$

22. **(a)**

The difference equation is,

$$y[n] + 0.5\, y[n-1] = x[n]$$

Characteristic equation,

$$\lambda + 0.5 = 0, \qquad \text{root, } \lambda = -0.5$$

$$y_H[n] = C_1(-0.5)^n$$

$$y_P[n] = K$$

$$K + 0.5\,K = 1$$

$$\Rightarrow \qquad K = \frac{2}{3}$$

So, $$y_p[n] = \frac{2}{3}u[n]$$

Complete response,

$$y[n] = y_h[n] + y_p[n]$$

$$= C_1(-0.5)^n + \frac{2}{3}$$

Using given initial conditions,

© Copyright: MADE EASY

$$y[-1] = C_1(-0.5)^{-1} + \frac{2}{3} = 0$$

$$\Rightarrow \quad C_1 = \frac{1}{3}$$

and, $$y[n] = \left[\frac{1}{3}\left(\frac{-1}{2}\right)^n + \frac{2}{3}\right]u[n]$$

Alternative Solution:

$$x[n] = 0.5y[n-1] + y[n]$$

Taking z-transform,

$$X(z) = Y(z) + 0.5\left[z^{-1}Y(z) + 0\right]$$

$$\Rightarrow \quad \text{Put, } X(z) = \frac{z}{z-1} \qquad [\because x[n] = u(n)]$$

$$Y(z) = \frac{z}{(z-1)(z+0.5)}$$

by partial fraction method,

$$\frac{A}{(z+0.5)} + \frac{B}{(z-1)} = \frac{z}{(z-1)(z+0.5)}$$

Sovling, $$A = \frac{1}{3},$$

$$B = \frac{2}{3}$$

Hence, $$y[n] = \left[\frac{1}{3}[-0.5]^n + \frac{2}{3}\right]u[n]$$

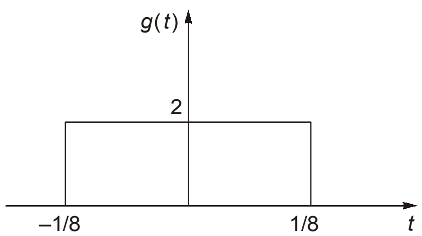
23. (d)

$$g(t) = \text{rect}(4t) * 4\delta(-2t)$$

$$= 4\ \text{rect}(4t) * \delta(-2t) \qquad (\because \delta(-t) = \delta(t))$$

$$= 2\ \text{rect}(4t) \qquad \left(\because \delta(at) = \frac{1}{|a|}\delta(t)\right)$$

thus $g(t)$ is given as



now,

$$\text{rect}\ (t) \xleftrightarrow{F.T} \text{sinc}(f)$$

$$2\text{rect}\ (t) \xleftrightarrow{F.T} 2\,\text{sinc}(f)$$

$$2\text{rect}\ (4t) \xleftrightarrow{F.T} 2 \cdot \frac{1}{4}\text{sinc}\left(\frac{f}{4}\right) \qquad \text{(scaling property)}$$

$$\therefore \quad 2\text{rect}\ (4t) \xleftrightarrow{F.T} \frac{1}{2}\text{sinc}\left(\frac{f}{4}\right)$$

24. (c)

Given that,

Let, $$y_1(t) = 2\pi X(-\omega)\big|_{\omega = t}$$

We have, $$y_1(t) = 2\pi \int_{u=-\infty}^{\infty} x(u)e^{jut}du$$

Similarly, let $y_2(t)$ be the output due to passing $x(t)$ through 'F' twice.

$$y_2(t) = 2\pi \int_{v=-\infty}^{\infty} 2\pi \int_{u=-\infty}^{\infty} x(u)e^{juv}du\, e^{jtv}dv$$

$$= (2\pi)^2 \int_{u=-\infty}^{\infty} x(u) \int_{v=-\infty}^{\infty} e^{j(t+u)v}dv\,du$$

$$= (2\pi)^2 \int_{u=-\infty}^{\infty} x(u)(2\pi)\delta(t+u)du$$

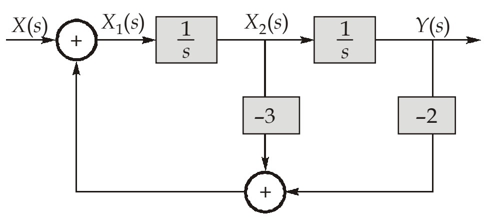
$$= (2\pi)^3\, X(-t)$$

Finally, let $y_3(t)$ be the output due to passing $x(t)$ through F three times

$$y_3(t) = 2\pi \int_{u=-\infty}^{\infty} (2\pi)^3 x(-u)e^{jtu}du$$

$$= (2\pi)^4 \int_{-\infty}^{\infty} e^{-jtu}x(u)du = (2\pi)^4\, X(t)$$

25. (b)



now, $$Y(s) = \frac{X_2(s)}{s},$$

$$X_2(s) = \frac{X_1(s)}{s}$$

now, $$X_1(s) = X(s) - 2Y(s) - 3X_2(s)$$

$$s^2Y(s) = X(s) - 3sY(s) - 2Y(s)$$

$$(s^2 + 3s + 2)Y(s) = X(s)$$

© Copyright: MADE EASY

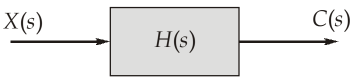
$$\frac{Y(s)}{X(s)} = \frac{1}{s^2+3s+2} = \frac{1}{(s+1)(s+2)}$$

$$\frac{Y(s)}{X(s)} = \frac{1}{s+1} - \frac{1}{s+2}$$

26. (d)

Let, the given transfer function,

$$H(s) = \frac{b(s+a)}{(s+b)}$$



where, $X(s) = \frac{1}{s}$ ($\because$ unit step response)

$$C(s) = X(s)H(s) = \frac{b(s+a)}{s(s+b)}$$

Given, $c(0) = 2$

$$\Rightarrow \quad \underset{s \to \infty}{Lt}\; s \cdot \frac{b(s+a)}{s(s+b)} = 2$$

$$b = 2$$

and $c(\infty) = 8$

$$\Rightarrow \quad \underset{s \to 0}{Lt}\; s \cdot \frac{b(s+a)}{s(s+b)} = 8$$

$$a = 8$$

now, $\frac{a}{b} = \frac{8}{2} = 4$

27. (d)

We know that

$$FT[e^{-t}u(t)] = \frac{1}{1+j\omega}$$

Using duality property

$$x(t) \xleftrightarrow{FT} X(\omega)$$

$$X(t) \xleftrightarrow{FT} 2\pi x(-\omega)$$

we have

$$FT\left[\frac{1}{1+jt}\right] \xleftrightarrow{FT} 2\pi e^{-(-\omega)}\, u(-\omega)$$

$$\xleftrightarrow{FT} 2\pi e^{\omega}\, u(-\omega)$$

Using the time reversal property,

i.e. $x(-t) = X(-\omega)$, we have

$$FT\left[\frac{1}{1-jt}\right] \xleftrightarrow{FT} 2\pi e^{-\omega}\, u(\omega)$$

$$\therefore \quad e^{-\omega}u(\omega) \xleftrightarrow{IFT} \frac{1}{2\pi}FT\left[\frac{1}{1-jt}\right]$$

$$\therefore \quad FT^{-1}\left[e^{-\omega}u(\omega)\right] = \frac{1}{2\pi(1-jt)}$$

28. (b)

Given, $$X(s) = \ln\left[1+\frac{\omega^2}{s^2}\right]$$

Let $$x(t) = L^{-1}[X(s)] = L^{-1}\left[ln\left(1+\frac{\omega^2}{s^2}\right)\right]$$

$$\therefore \quad L[x(t)] = \ln\left[1+\frac{\omega^2}{s^2}\right] = \ln\left[\frac{s^2+\omega^2}{s^2}\right]$$

$$= \ln[s^2+\omega^2] - ln\, s^2$$

$$L[t\,x(t)] = \frac{-d}{dS}\left[\ln(s^2+\omega^2)-\ln s^2\right]$$

$$= \frac{-1}{s^2+\omega^2}\cdot 2s + \frac{1}{s^2}2s = \frac{2}{s} - \frac{2s}{s^2+\omega^2}$$

$$\therefore \quad t\,x(t) = L^{-1}\left[\frac{2}{s}-\frac{2s}{s^2+\omega^2}\right]$$

$$= (2 - 2\cos\omega t)u(t) = 2(1-\cos\omega t)u(t)$$

$$\therefore \quad x(t) = \frac{2(1-\cos\omega t)}{t}u(t)$$

29. (b)

$$Y(z) = X(z)\cdot H(z)$$

for unit step input, $X(z) = \dfrac{1}{1-z^{-1}}$ $\quad (\because x[n] = \text{unit step})$

$$\therefore \quad Y(z) = \frac{z^3}{(z-1)\left(z-\frac{1}{2}\right)\left(z-\frac{1}{4}\right)}$$

$$\frac{Y(z)}{z} = \frac{C_1}{z-1} + \frac{C_2}{z-\frac{1}{2}} + \frac{C_3}{z-\frac{1}{4}}$$

$$C_1 = \left.\frac{z^2}{\left(z-\frac{1}{4}\right)\left(z-\frac{1}{2}\right)}\right|_{z=1} = \frac{8}{3}$$

© Copyright: MADE EASY

$$C_2 = \left.\frac{z^2}{(z-1)\left(z-\frac{1}{4}\right)}\right|_{z=\frac{1}{2}} = -2$$

$$C_3 = \left.\frac{z^2}{(z-1)\left(z-\frac{1}{2}\right)}\right|_{z=\frac{1}{4}} = \frac{1}{3}$$

$\therefore$
$$Y(z) = \frac{8}{3}\frac{z}{z-1} - 2\frac{z}{z-\frac{1}{2}} + \frac{1}{3}\frac{z}{z-\frac{1}{4}}$$

Taking inverse z-transform,

$$y[n] = \frac{1}{3}\left[8 - 6\left(\frac{1}{2}\right)^n + \left(\frac{1}{4}\right)^n\right]u[n]$$

30. **(c)**

- Linear in $x[n]$
- Upper limit of summation operator is a function of n $\Rightarrow$ Time variant
- $n^2 > n \Rightarrow$ non causal
- When $x[n]$ is bounded, $y[n]$ is also bounded $\Rightarrow$ Stable

■■■■