# SIGNALS & SYSTEMS
# INTRODUCTION & LTI SYSTEMS

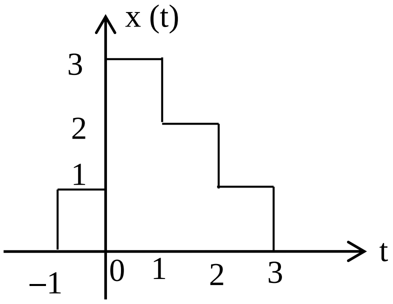
1. The value of integral $\int_{0}^{2\pi} t\sin\frac{t}{2}\,\delta(\pi-t)\,dt$

(a) π (b) 0 (c) 1 (d) ∞

Ans : (a)

1.1. The equation of the signal x(t) shown in fig. is

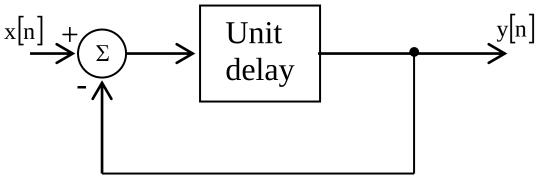
(a) x(t) = u(t + 1) – 2u(t) – u(t – 1) – u(t – 2) – u(t + 3)
(b) x(t) = u(t+1) + 2u(t) – u(t –1) – u(t –2) – u(t –3)
(c) x(t) = – u(t+1) – 2u(t) + u (t-1) – u(t –2) – u(t –2) – u(t –3)
(d) x(t) = u(t +1) – 3 u(t) – u(t – 1) – u(t – 2)



Ans : (b)

1.9. The I/p - O/p relation ship of feedback system shown in fig. is

(a) y(n) – y(n – 1) = x[n – 1] (b) y(n) + y(n – 1) = x[n]
(c) y(n) + y(n – 1) = x[n – 1] (d) None of these



Ans : (c)

4. The value of the integral $\int_{-\infty}^{+\infty} e^{-t}\,\delta(t)\,dt$ is ______

(a) 1 (b) – 1 (c) 0 (d) ∞

Ans (a)

5. The signal x[n] = $2e^{j3n}$ is ______

(a) an energy signal (b) a power signal
(c) neither an energy nor a power signal (d) None of these

Ans : (b)

1.2 let x [n] be a signal with x[n] = 0 for n < - 2 & n > 4. then the signal x[- n + 2] is guaranteed to be zero in the interval _____

(a) n < 1 & n > 7 (b) n <-4 & n > 2 (c) n <-2 & n > 4 (d) n <-6 & n>0

Ans : (c)

7. consider a continuous – time system with i/p $x(t)$ & 0/p $y(t)$ related by $y(t) = x\{\sin t\}$. This system is _______

(a) causal & linear (b) non causal & linear
(c) causal & non linear (d) non causal & non linear

Ans : (b)

8. consider discrete time system with i/p $x(n)$ & 0/p $y(n)$ related by $y(n) = \sum_{k=n-n_0}^{n+n_0} x(k)$ where $n_0$ is a finite +ve integer this system is __________

(a) linear & time – invariant (b) linear & time – variant
(c) nonlinear & time – variant (d) nonlinear & time – invariant

Ans (a)

9. the fundamental period of signal $x(t) = 2\cos(10\pi t + \frac{\pi}{6})$ is ______

(a) 0.2 secs (b) 1.176 (c) 11.76 (d) 5

Ans : (a)

1.8. If $(3+C_1)\ \delta^{\bullet\bullet\bullet\bullet}(t) + C_2\ \delta^{\bullet\bullet}(t) + C_3\ \delta^{\bullet}(t) = C_4\ \delta^{\bullet\bullet\bullet}(t) + C_5\ \delta(t)$ then ________

(a) $C_1 = 0, C_2 = C_3 = C_4 = -1, C_5 = 0$ (b) $C_1 = -3$ & all other Cs ax zero
(c) $C_1 = 0, C_2 = -3, C_3 = -1, C_4 =, C_5 = 0$ (d) none of these

Ans : (b)

12. The signal $e^{2t}\,u(t)$ is ______

(a) an energy signal (b) a power signal
(c) neither an energy nor a power signal (d) none

Ans : (c)

1.3. Value of $\int_{-2}^{4} \cos(2\pi t)\ \delta(2t+1)\,dt$ is ______

(a) 01 (b) 1 (c) -0.5 (d) 0.5

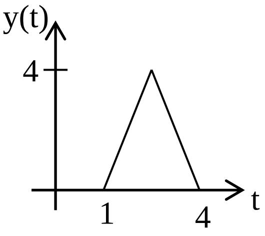
Ans : (c)

14. The power in the signal $x(t) = 2\sin\left(\frac{2t}{3}\right) + 4\cos\left(\frac{t}{2}\right) + 4\cos\left(\frac{t}{3} - \frac{\pi}{5}\right)$ is

(a) 18 (b) 36 (c) 6 (d) 12

Ans : (b)

15. The energy in the signal y(t) shown in figure is ______



(a) 24 9b) 16 (c) 4 (d) 8

Ans : (b)

16. The value of $\int_{-2}^{2} (t-3)\delta(2t+2) + 8\cos(\pi t)\,\dot{\delta}(t-0.5)\,dt$ is _______

(a) – 2 + 8 π (b) -8 π - 2 (c) -3 (d) -8

Ans : (a)

17. Consider a periodic signal x[n] = 6cos $\left[\frac{2\pi n}{4}\right]$. Then power in x(n) is ______

(a) 36 w (b) 18 w (c) 12 w (d) 6 w

Ans : (b)

18. Let x(n) = $\{1, \underset{\uparrow}{2}, 5, -1\}$ then x(2n) is _______

(a) $\{-\underset{\uparrow}{1}, 2\}$ (b) $\{\underset{\uparrow}{2}, -1\}$ (c) $\{1, \underset{\uparrow}{5}\}$ (d) $\{1, \underset{\uparrow}{5}, -1\}$

Ans : (b)

1.4. The signal x(t) = 2cos $(40\pi t) + \sin(60\pi t)$ is sampled at 75 HZ. Then period of discrete – time signal $x[n]$ is _____

(a) 15 (b) 30 (c) 15π (d) 16

Ans : (a)

20. The relation y(t) = x(t) $\frac{dx(t)}{dt}$ is ______

(a) linear & time – invariant (b) linear & time – variant
(c) nonlinear & time – invariant (d) nonlinear & time – variant

Ans : (d)

21. The differential equation relating i/p x(t) & 0/p y(t) is given by $y^{\bullet}(t) - 4y(t)\,y(2t) = x(t)$. Then this systems is ___________

(a) linear & time – invariant (b) linear & time – variant
(c) nonlinear & time – invariant (d) nonlinear & time – variant

Ans : (d)

22. The equation $y^{\bullet}(t+4) + 2y(t) = x(t+2)$ is

(a) causal & dynamic (b) noncausal & dynamic
(c) causal & static (d) noncausal & static

Ans : (a)

23. The equation $y[n] = x[n] + 3u[n+1]$ is _______

(a) static & time – invariant (b) static & time- variant
(c) dynamic & time – invariant (d) dynamic & time – variant.

Ans : (b)

24. The impulse response of the system described by $y^{\bullet}(t) + 2y(t) = x(t)$ is ______

(a) $e^{-2t}u(t)$ (b) $e^{-2t}$ (c) $e^{2t}u(-t)$ (d) $e^{2t}u(t)$

Ans : (a)

25. The system $y^{ll}(t) + 3y^{l}(t) = x(t)$ is __________

(a) stable (b) unstable (c) marginally stable (d) none

Ans : (b)

26. The system $y[n] = 2^{x[n]}x[n]$ is _______

(a) linear & time – invariant (b) linear & time – variant
(c) nonlinear & time – invariant (d) nonlinear & time – variant

Ans : (c)

27. The system equation $y[n] - 4y[n]y[2n] = x[n]$ is _______

(a) linear & time – variant (b) linear & time – variant
(c) nonlinear & time – invariant (d) nonlinear & time – variant

Ans: (d)

28. The system equation $y[n+4] + y[n+3] = x[n+2]$ is _________

(a) Causal and static (b) non causal and static
(c) Causal and dynamic (d) non causal and dynamic

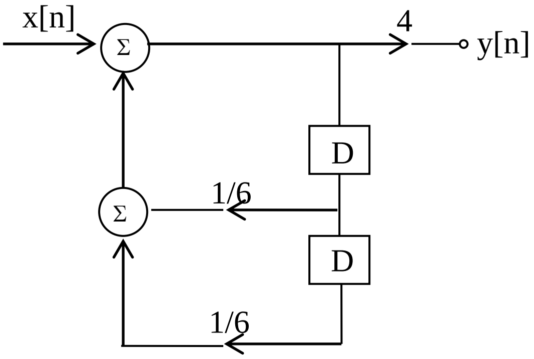
Ans : (c)

29. Given y[n]= y[n – 1] + x[n] – x [n – 3]. Assume y[n] = 0 for n < 0 then y[n] = ______

(a) {1, 1, 1, 0, 0, 0, -------} (b) {1, 0, 1, 0, 1, 0, ---------}
(c) {0, 0, 0, 1, 1, 1, 0, 0, 0, -------} (d) {1, -1, 1, -1, 1, -1, -----------}

Ans : (a)

30. For the system shown in fig. the relation between is i/p x[n] & 0/p y[n] is ________



(a) $y[n]+\frac{1}{6}y[n-1]-\frac{1}{6}y[n-2]=4x[n]$

(b) $y[n]-\frac{1}{6}y[n-1]+\frac{1}{6}y[n-2]=x[n]$

(c) $y[n]-\frac{1}{6}y[n-1]-\frac{1}{6}y[n-2]=4x[n]$

(d) $y[n]+\frac{1}{6}y[n-2]=x[n]$

Ans : (c)

## SIGNALS & SYSTEMS
## FOURIER SERIES

1. Let x(t) be a signal with x(t) = 0 for t < 3. then the value of 't' for which the signal x(1 - t) x (2 – t) is guaranteed to be zero is _________

(a) t < 1 (b) t < - 2 (c) t > - 2 (d) t > 1

2. The power & energy of a signal x(t) = cost are ________ respectively.

(a) 0 & $\frac{1}{4}$ (b) $\frac{1}{2}$ & ∞ (c) 0 & $\frac{4}{3}$ (d) ∞ & 1

3. Consider a signal x(t) = $\delta(t+2)-\delta(t-2)$. If a signal y(t) = $\int_{-\infty}^{t} x(\tau)d\tau$ is considered energy in y(t) is given by _______

(a) 2 (b) 4 (c) ∞ (d) 1

4. The fundamental period of a signal $x(n) = 1 + e^{\frac{j4\pi n}{7}} - e^{\frac{j2\pi n}{5}}$ is ____________

(a) 35 (b) 10 (c) 7 (d) none of these

5. A system with i/p x(t) & 0/p y(t) are related through a equation $y(t) = x\{\sin t\}$. This system is _________

(a) linear & causal (b) linear & noncausal
(c) nonlinear & causal (d) nonlinear & noncausal

6. The value of $4t^2\ \delta(2t-4)$ is __________

(a) $16\ \delta(t-2)$ (b) $64\ \delta(t-2)$ (c) $8\ \delta(t-2)$ (d) none of these.

1.5. The value of $\dot{\delta}(-t)$ is ______

(a) $\dot{\delta}(t)$ (b) $-\dot{\delta}(t)$ (c) $\delta(t)$ (d) $-\dot{\delta}(-t)$

8. The value of $\int_{0.5}^{1.5} 2\delta(t-2.5)\,dt$ is ___________

(a) 2 (b) 0 (c) 1 (d) $\infty$

9. Let $x[n] = \{3, \underset{\uparrow}{4}, -3, -1\}$. Then x(2n) is ___________

(a) {3, -3} (b) {4, -1} (c) {3, -1} (d) {4, -3}

10. The signal $x[n] = e^{j\left[n/4-\pi\right]}$ is _______

(a) periodic with period $N = 8\pi$ (b) aperiodic
(c) periodic with period N= ¼ (d) none of these

11. The fundamental period of $x[n] = \cos\left[\frac{\pi n^2}{8}\right]$ is ________

(a) 16 (b) 4 (c) 8 (d) 2

12. The value of $\int_{-\infty}^{+\infty} \cos t\, u(t-1)\delta(t)dt$ is ___________

(a) 1 (b) 0 (c) cos 1 (d) $\infty$

1.11. If a continuous – time system is represented as $y(t) = \sum_{k=-\infty}^{+\infty} x(t)\delta(t-KTs)$. then the system is___________

(a) linear & time – invariant (b) periodic with period = 1
(c) nonlinear & time – invariant (d) nonlinear & time – variant.

14. The signal $x(t) = \cos(2\pi t)\, u(t)$ is _______

(a) periodic wih period = $2\pi$ (b) periodic with period = 1
(c) non periodic (d) none of these

15. If x[n] is an odd signal then $\sum_{n=-\infty}^{+\infty} x[n] =$ __________

(a) 0 (b) 2 x[n] (c) $\infty$ (d) data is insufficient

16. If $x_1[n]$ is an odd signal & $x_2$ [n] is an even signal, then their product is __________

(a) an even signal (b) an odd signal (c) neither even nor odd (d) none.

17. The value of $\delta(2t)$ & $\delta(2n)$ are respectively _______

(a) $\frac{1}{2}\delta(t)$ & $\delta[n]$ (b) $\frac{1}{2}\delta(t)$ & $\frac{1}{2}\delta[n]$

(c) 2s(t) & $\frac{1}{2}\delta[n]$ (d) $2\delta(t)$ & $2\delta[n]$

18. The equation $y^1(t) + 2y(t) = x(t + 5)$ is ________

(a) causal & static (b) causal & dynamic
(c) noncausal & static (d) noncausal & dynamic

19. The system equation y(t) = x(-t) is ________

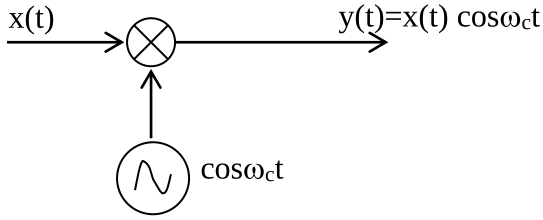
(a) time – invariant & causal (b) time – invariant & non causal
(c) time – variant & causal (d) time – variant & non causal

20. The causal impulse response of a first order system is y[n] - 0.4 y [n – 1] = x[n] is ____

(a) $(0.4)^{n+1}$ 4[n + 1] (b) $(0.4)^n$ 4[-n]
(c) $(0.4)^n$ 4[n] (d) $(0.4)^n$ 4[n-1]

**PART – II**

**1.10.** Consider system shown in figure Let ‘p’ indicates memory less ‘Q’ → causality ‘R’ → linearity ‘S’ → Time-invariant. This system is __________



(a) P, Q, R but not S (b) R, Q, S but not R

(c) P, Q, R, S (d) None of these

**22.** Consider a periodic signal $x(t) = \begin{cases} 1, & 0 \le t \le 1 \\ -2, & 1 < t < 2 \end{cases}$ with period T = 2.

The derivative of this signal is related to "impulse train" $g(t) = \sum_{K=-\infty}^{+\infty} \delta(t-2K)$

With $T = 2$ & $\frac{dx(t)}{dt} = A_1 g(t-t_1) + A_2 g(t-t_2)$ .

Then values of $A_1$, $t_1$, $A_2$ & $t_2$ are _________ respectively.

(a) 3, 0, –3, –1 (b) 3, –3, 0, –1 (c) 3, 0, –3, 1 (d) –3, 0, 3, 1

**1.19.** The unit impulse response of an LTI system is unit step function u(t). For t>0, response of system to an excitation $e^{-at}$ u(t), a>0 will be __________

(a) $ae^{-at}$ (b) $\frac{1}{a}(1-e^{-at})$ (c) $a(1 - e^{-at})$ (d) $1 - e^{-at}$

**1.20.** Let $y(t) = e^{-t}\,u(t) * \sum_{K=-\infty}^{+\infty} \delta(t-3K)$. If $y(t) = Ae^{-t}$ for $0 \le t \le 3$. The value of A is ___

(a) $\frac{1}{1-e^{3}}$ (b) $\frac{1}{e^{3}-1}$ (c) $\frac{1}{1+e^{-3}}$ (d) $\frac{1}{1-e^{-3}}$

**25.** A linear system, has the relationship

$y[n] = \sum_{K=-\infty}^{+\infty} x[K]\,g[n-2K]$ between its input x[n] & output y[n]

where g[n] = u[n]–u[n–4]. If x[n] = $\delta[n-1]$, y[n] is ______

(a) u[n] – u[n–4] (b) u[n–4] –u[n–8]

(c) u[n–2] –u[n–6] (d) $2u[n] - \delta[n] - \delta[n-1]$

**1.18** Let $x[n] = \delta[n] + 2\delta[n-1] - \delta[n-3]$ & $h[n] = 2\delta[n+1] + 2\delta[n-1]$. Then x[n] * h[n] is _____

(a) $\{2, \underset{\uparrow}{4}, 2, 2, 0, -2\}$ (b) $\{4, \underset{\uparrow}{2}, 1, -2, 1, 2\}$

(c) $\{-2, 2, \underset{\uparrow}{0}, 1, -2, 1\}$ (d) $\{2, -\underset{\uparrow}{4}, 2, 2, -2, 0\}$

**27.** Given x(t) = u(t – 3) – u(t–5) & h(t) = $e^{-3t}$ u(t). Then $\frac{dx(t)}{dt} * h(t)$ is _____

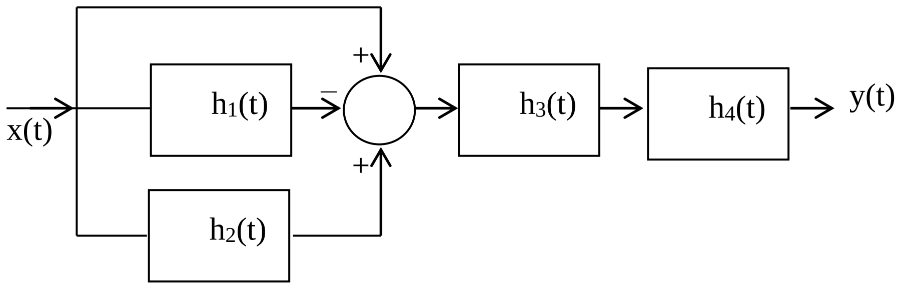
(a) $\left[e^{-3(t-3)} - e^{-3(t-5)}\right]; t>0$ (b) $(e^{-3t} - e^{-5t})\,u(t-3)$

(c) $e^{-3(t-3)} + e^{-5(t-5)}$ ; $t>0$ (d) $e^{-3(t-3)}\,u(t-3) - e^{-3(t-5)}\,u(t-5)$

**1.12**. Consider a causal LTI system given by $y[n] - \frac{1}{4}y[n-1] = x[n]$. Where x[n] is input & y[n] is output. If x[n] = $\delta[n-1]$, then y[n] is _______

(a) $\left(\frac{1}{4}\right)^{n} u[n]$ (b) $\left(\frac{1}{4}\right)^{n-1} u[n]$ (c) $\left(\frac{1}{4}\right)^{n-1} u[n-1]$ (d) $\left(\frac{1}{4}\right)^{n} u[n-1]$

**29.** The overall impulse response of the system shown in figure is



(a) $\{h_1(t) - \delta(t) + h_2(t)\} * \{h_3(t) + h_4(t)\}$

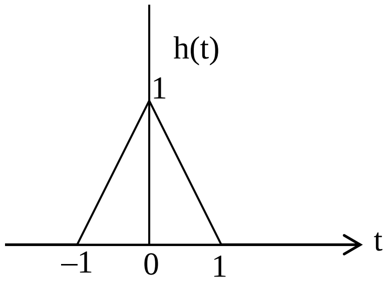
(b) $\{\delta(t) - h_1(t) + h_2(t)\} + \{h_3(t) * h_4(t)\}$

(c) $\{\delta(t) - h_1(t) + h_2(t)\} * h_3(t) * h_4(t)$

(d) $\{u(t) - h_1(t) + h_2(t)\} * h_3(t) * h_4(t)$

30. Let h(t) be a triangular pulse shown in figure (a) and let x(t) be the unit impulse train shown in figure (b) given by $x(t) = \delta_T(t) = \sum_{n=-\infty}^{+\infty} \delta(t - nT)$

The value of y(t) = x(t) * h(t) for T = 3 is given by ______



**Fig(a)**

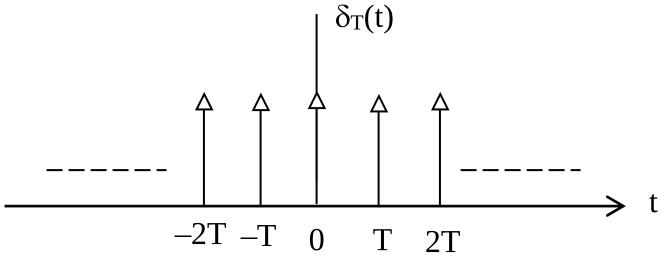
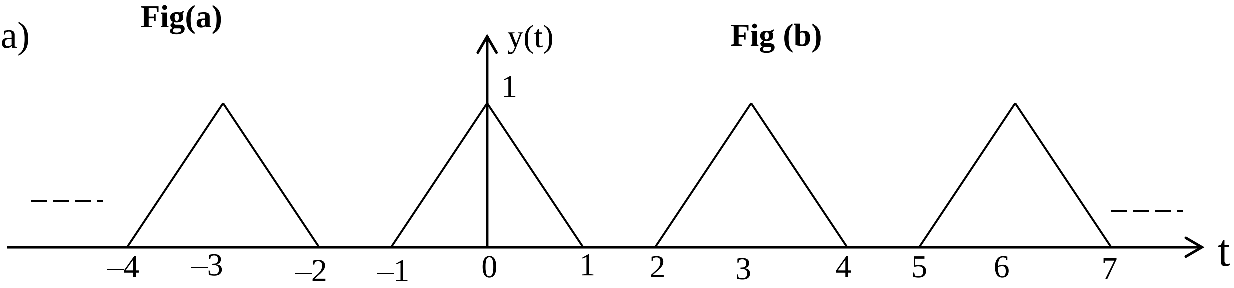
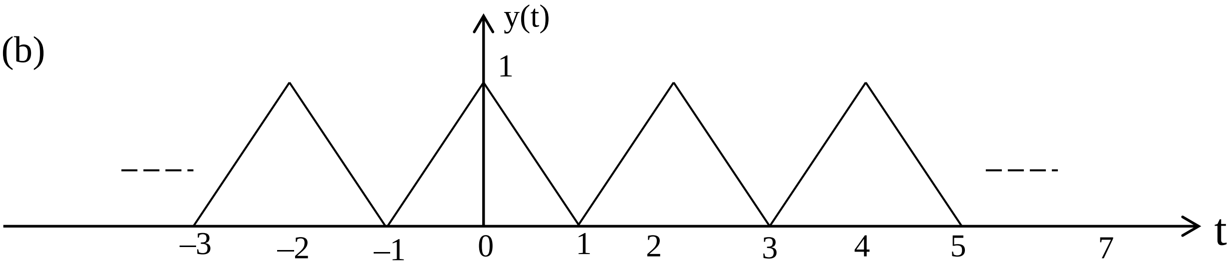


**Fig (b)**

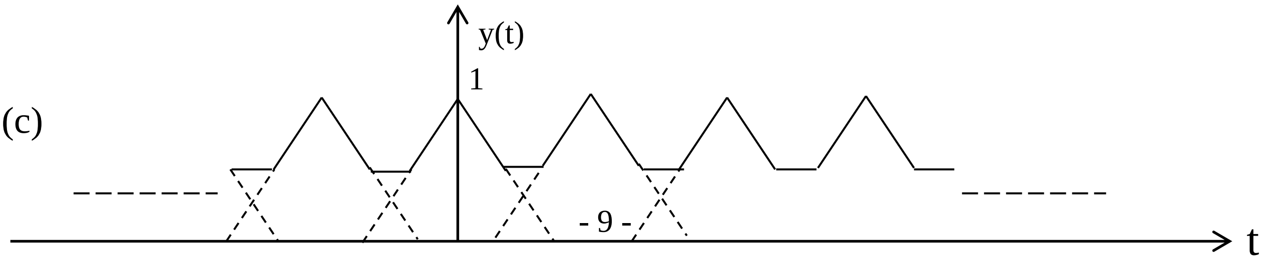
(a)



(b)

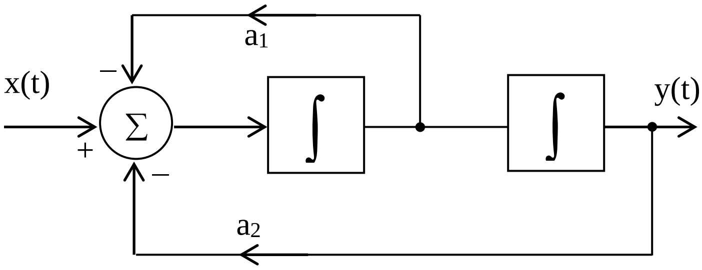


(c)



(d) None of these

31. The deferential equation relating input x(t) and output y(t) of system shown in figure



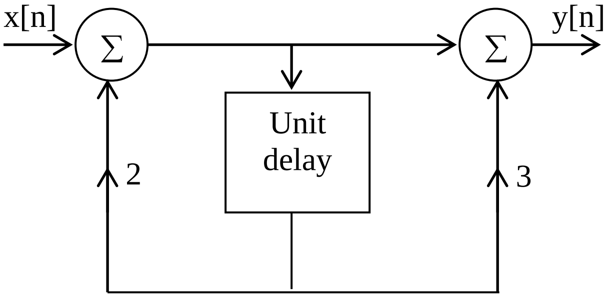
(a) $\frac{d^2y(t)}{dt^2} + a_1\frac{dy(t)}{dt} + a_2\, y(t) = x(t)$ (b) $\frac{d^2y(t)}{dt^2} - a_1\frac{dy(t)}{dt} - a_2\, y(t) = x(t)$

(c) $\frac{d^2y(t)}{dt^2} - a_1\frac{dy(t)}{dt} + a_2\, y(t) = x(t)$ (d) $\frac{d^2y(t)}{dt^2} + a_1\frac{dy(t)}{dt} - a_2\, y(t) = x(t)$

**1.13.** The step response of a discrete-time LTI system is $s[n] = \alpha^n u[n]$ $0 < \alpha < 1$
The impulse response is given by _______
(a) $\delta[n]-(1-\alpha)\alpha^{n-1}u[n-1]$ (b) $\alpha^n u[n]- \alpha^n u[n-1]$
(c) $(1-\alpha)\alpha^n u[n]$ (d) None of these

**1.14.** Consider a system with impulse response $h[n] = \alpha^n u[n]$, $0<\alpha<1$ this system is ____
(a) causal & stable (b) Non causal & stable
(c) causal & unstable (d) Non causal & unstable

**1.15**. The difference equation relating input x[n] and output y[n] of the system shown in figure is given by



(a) $y[n] + 2y[n-1] = x[n] - 3x[n-1]$ (b) $y[n] + y[n-1] = 2x[n] + 3x[n-1]$

(c) $y[n] + 3y[n-1] = x[n] - 2x[n-1]$ (d) $y[n] - 2y[n-1] = x[n] + 3x[n-1]$

**1.16.** Given a causal LTI discrete-time system is given by

$y[n] - \frac{1}{2}y[n-2] = 2x[n] - x[n-2]$. Then impulse response is _____

(a) $h[n] = \{1, 0, -2, 1\}$ (b) $h[n] = 2^n u[n]$

(c) $h[n] = 2\delta[n]$ (d) $h[n] = u[n]$

# Fourier Series

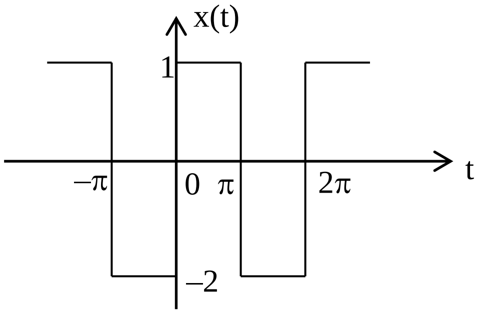
**2.1.** The periodic signal shown in figure contains _______

(a) d.c. & sine terms only for odd harmonics

(b) d.c. & cosine terms

(c) d.c. & sine terms

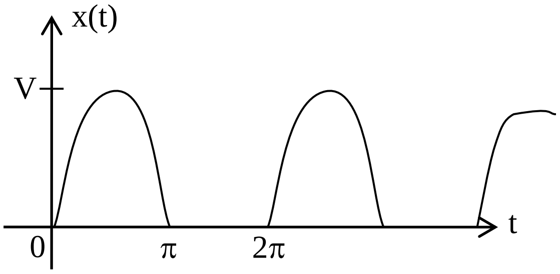
(d) None of these



**2.** A harmonic signal $x(t) = 3\sin(4t+20^o) - 4\cos(12t+40^o)$. The phase of III harmonic is ___

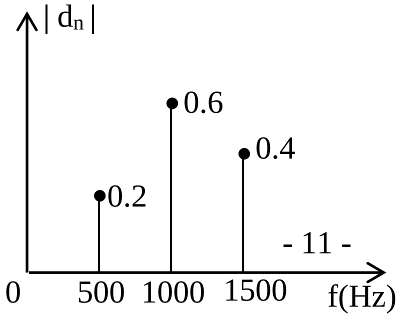
(a) 180° (b) 40° (c) 140° (d) None of these

**2.2**. The average value for the periodic signal shown in figure



(a) $\frac{2V}{\pi}$ (b) $\frac{V}{\pi}$ (c) $\frac{V}{2\pi}$ (d) None

4. A periodic function y(t) is known to have odd symmetry & the amplitude spectrum is shown in figure. If all the coefficients are non negative. Then Fourier series for y(t) is ____



(a) $0.2 \sin 1000\pi t + 0.6 \sin 2000\pi t + 0.4 \sin 3000\pi t$
(b) $0.4 \sin 1000\pi t + 0.6 \sin 2000\pi t + 0.8 \sin 3000\pi t$
(c) $0.2 \cos 1000\pi t + 0.6 \cos 2000\pi t + 0.4 \cos 3000\pi t$
(d) None

**2.3.** A continuous-time periodic signal x(t) is real valued & has a fundamental period T = 8. The non zero F.S. coefficients for x(t) are
$a_1 = a_{-1} = 2$, $a_3 = a_{-3} = 4j$. Then x(t) in TFS form is _____

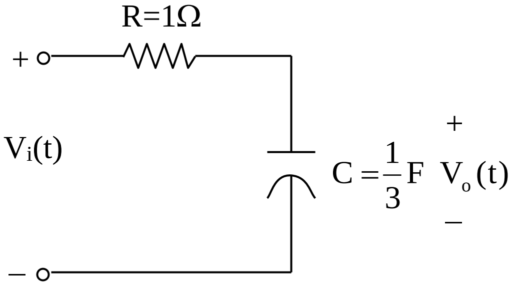
(a) $4\cos\left(\frac{\pi t}{4}\right) + 8\cos\left(\frac{3\pi t}{4}\right)$ (b) $4\cos\left(\frac{\pi t}{4}\right) + 8\cos\left(\frac{3\pi t}{4} + \frac{\pi}{2}\right)$

(c) $4\cos\left(\frac{\pi t}{8}\right) + 8\cos\left(\frac{3\pi t}{8}\right)$ (d) None

**6.** Consider a C.T.LTI system with frequency response $H(\omega) = \begin{cases} 1; |\omega| \le 250 \\ 0; |\omega| > 250 \end{cases}$.

When the input to this system is a signal x(t) with fundamental period $\pi/7$ & F.S. coefficient $a_K$ & y(t) → x(t). For what values of K it is guaranteed that $a_K = 0$?
(a) $|K| \ge 18$ (b) $|K| > 19$ (c) $|K| > 17$ (d) $|K| \ge 17$

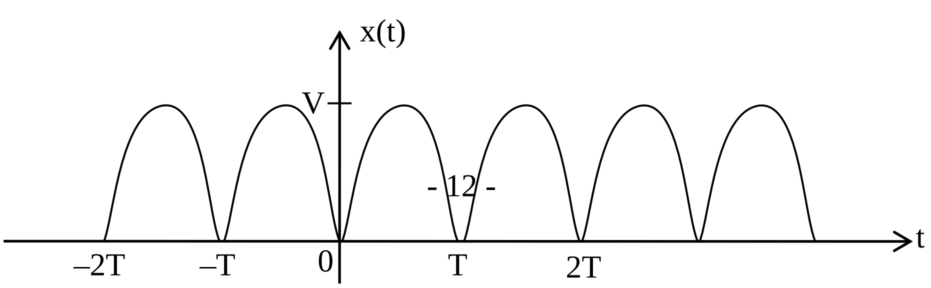
**2.5.** A periodic voltage waveform $V_i(t) = 4 - \sum_{n=1}^{\infty} \frac{10}{n} \sin(3nt)$ volts is applied to RC circuit shown in figure the amplitude of first harmonic is ______



(a) 7.07 (b) 2.2361 (c) 4 (d) 1.054

**8.** In the above problem phase of III harmonic is ______
(a) $45^o$ (b) $26.6^o$ (c) $18.4^o$ (d) None

**9.** The exponential F.S. coefficient for the periodic signal shown in figure is ___ ($x(t) \to C_n$)



(a) $\frac{-2V}{\pi(4n^2-1)}$   (b) $\frac{2}{\pi(1-4n^2)}$   (c) $\frac{V}{\pi(4n^2+1)}$   (d) $\frac{V}{\pi(1-4n^2)}$

**10.** The d.c. value for the above problem is _______

(a) $\frac{2V}{\pi}$   (b) $\frac{V}{\pi}$   (c) $\frac{V}{2\pi}$   (d) None

**2.4.** Given the periodic signal $x(t) = \sum_{n=-\infty_{(neven)}}^{+\infty} u(t-3n) - u(t-3n-1)$. The d.c. component of this signal is ____

(a) $\frac{1}{6}$   (b) $\frac{1}{3}$   (c) $\frac{1}{2}$   (d) None

12. Given an LTI system with h(t) = $\alpha e^{-\alpha t} u(t)$, $\alpha > 0$. The input signal is x(t) = $\sin^2 2t$. The output signal has the d.c. value as ______

(a) $\frac{1}{2}$   (b) 0   (c) 0   (d) $\infty$

**2.6.** Given the signal x(t) = $2\sin^2(2500\pi t)\cos(2 \times 10^4 \pi t)$. The average power in this signal is _____

(a) 0.25 watts   (b) 0.5 watts   (c) 0.75 watts   (d) 1 watt

14. In the above problem (Q13) if x(t) is transmitted through telephone system which block d.c. & frequencies above 12 KHz, compute the ratio of received to transmitted power?

(a) 8/5 W at o/p   (b) 5/8 W at o/p   (c) Data is insufficient   (d) None

**2.7.** The EFS of a signal is $x(t) = \sum_{n=-\infty}^{+\infty} \frac{1}{1+j\pi n} e^{\frac{j3\pi nt}{2}}$. The fundamental period is _______

(a) $3\pi/2$   (b) 4/3   (c) 3/4   (d) None

16. For a real periodic signal x(t), one of the coefficient is $C_1 = j2$ then $C_{-1}$ is _____

(a) 2   (b) –j 2   (c) – 2   (d) None

17. The average power in the signal x(t) = $4\sin 50\pi t$ is ________

(a) 8 W   (b) 16 W   (c) 2 W   (d) None

18. For an even periodic signal there are no ____

(a) d.c. & cosine terms   (b) sine terms

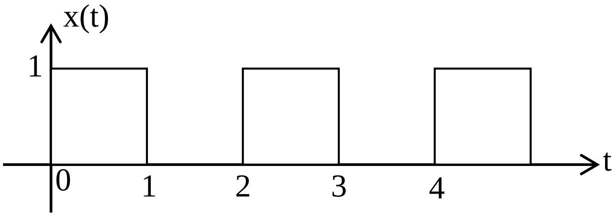
(c) d.c. & sine terms   (d) None of these

19. A periodic signal which contains odd harmonics is said to exhibit ____

(a) Even symmetry   (b) Odd symmetry

(c) Half-wave symmetry (d) either even or odd

**2.8.** The signal shown in figure exhibits ________ symmetry



(a) hidden even (b) hidden odd (c) half-wave (d) neither even nor odd

# SIGNAL & SYSTEM

**3.1**. A signal x(t) has a Fourier transform X(ω). If x(t) is a real & odd function of t, then X(ω) is _______

(a) a real & even function of ω (b) an imaginary & odd function of ω

(c) an imaginary & even function of ω (d) a real & odd function of ω

02. The Fourier series expansion of a periodic function contains only odd harmonics of sine waves. It is an

(a) even function with half-wave symmetry

(b) odd function with half-wave symmetry

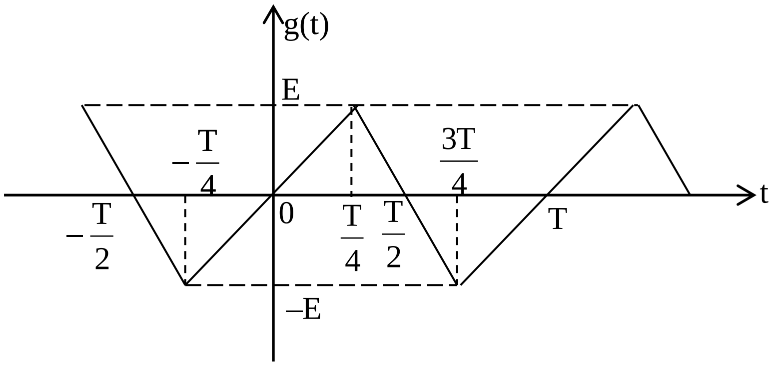
(c) even function without half-wave symmetry

(d) odd function without half-wave symmetry

03. Which one of the following is correct Fourier transform of unit step signal?

(a) $\pi\delta(\omega)$ (b) $\frac{1}{j\omega}$ (c) $\frac{1}{j\omega} + \pi\,\delta(\omega)$ (d) $\frac{1}{j\omega} + 2\pi\,\delta(\omega)$

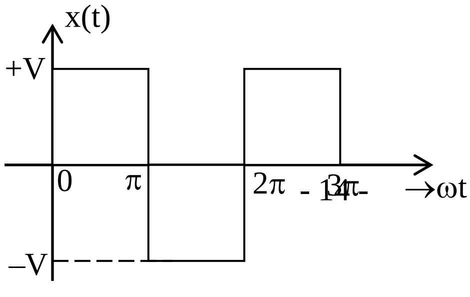
04. A periodic triangular wave is shown in figure. Its Fourier components will consist only of



(a) all cosine terms (b) all sine terms

(c) odd cosine terms (d) odd sine terms

**2.9.** The amplitude of the first odd harmonic of the square wave shown in figure is equal to



(a) $\frac{4V}{\pi}$ (b) $\frac{2V}{3\pi}$ (c) $\frac{V}{\pi}$ (d) 0

06. Let f(t) $\Leftrightarrow$ F(ω). Then F(0) is

(a) $\int_{-\infty}^{+\infty} f(t)\, dt$ (b) $\int_{-\infty}^{+\infty} |f(t)|^2\, dt$ (c) $\frac{1}{2\pi}\int_{-\infty}^{+\infty} f(t)\, dt$ (d) $\int_{-\infty}^{+\infty} t\, f(t)\, dt$

07. A periodic voltage having the Fourier series v(t) = 1+ 4 sinωt + 2 cosωt volts is applied across a one ohm resistor. The power dissipated in the one ohm resistor is __

(a) 1 W (b) 11 W (c) 21 W (d) 24.5 W

08. The Fourier transform of a voltage signal x(t) is X(f)., The unit of |X(f)| is _

(a) Volt (b) Volt-Sec (c) Volt/sec (d) Volt$^2$

09. The trigonometric Fourier series of an even function of time does not have_____

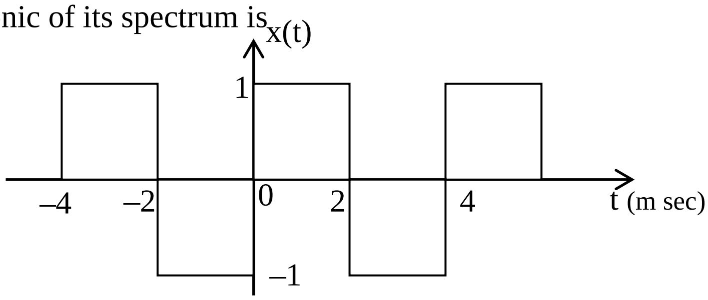
(a) d.c. term (b) cosine terms (c) sine terms (d) odd harmonic terms

10. The Fourier transform of a real valued time signal has

(a) odd symmetry (b) even symmetry

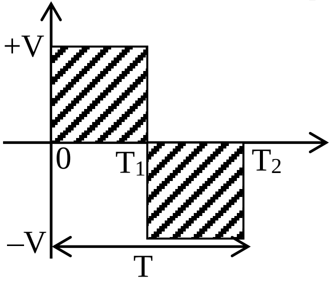
(c) conjugate symmetry (d) no symmetry

11. A periodic rectangular signal x(t) has the waveform shown in figure. Frequency of the fifth harmonic of its spectrum is



(a) 40 Hz (b) 200 Hz (c) 250 Hz (d) 1250 Hz

**2.13.** The r.m.s value of a rectangular wave of period T, having a value of +V for a duration, $T_1$ (<T) & – V for the duration T – $T_1$ = $T_2$, equals



(a) V (b) $\left(\frac{T_1 - T_2}{T}\right)V$ (c) $\frac{V}{\sqrt{2}}$ (d) $\frac{T_1 V}{T_2}$

**3.2** Match List-I (functions in the time-duration) with List-II (Fourier transform of the function) & select the correct answers using the codes given below

| **List – I**<br>f(t) | **List -II**<br>F($\omega$) |
|---|---|
| A. Delta function | 1. Delta Function |
| B. Gate function | 2. Gaussion function |
| C. Normalized Gaussion function | 3. Constant function |
| D. Sinusoidal function | 4. Sampling function |

| | A | B | C | D | | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|
| (a) | 1 | 2 | 4 | 3 | (b) | 3 | 4 | 2 | 1 |
| (c) | 1 | 4 | 2 | 3 | (d) | 3 | 2 | 4 | 1 |

**2.10.** Consider the following statements related to Fourier series of a periodic waveform

1. It expresses the given periodic waveform as a combination of d.c. component Sine & Cosine waveforms of different harmonic frequencies
2. The amplitude spectrum is discrete
3. The evaluation of Fourier coefficients gets simplified if waveform symmetries are used
4. The amplitude spectrum is Continuous

Which of the above statements are correct ?

(a) 1, 2 & 4 (b) 2, 3 & 4 (c) 1, 3 & 4 (d) 1, 2 & 3

**3.3**. Match List-I (functions) with List-II (Fourier transforms) & select the correct answer using the codes given below :

| **List – I (functions)** | **List – II(F.T)** |
|---|---|
| A. $e^{-\alpha t}\, u(t),\ \alpha > 0$ | 1. $\frac{1}{(\alpha + j2\pi f)^2}$ |
| B. $e^{-\alpha\|t\|},\ \alpha > 0$ | 2. $\frac{1}{\alpha + j2\pi f}$ |
| C. $t\ e^{-\alpha t}\ u(t),\ \alpha > 0$ | 3. $\delta\left(f - \frac{\alpha}{t_o}\right)$ |
| D. $e^{\frac{j2\pi\alpha t}{t_o}}$ | 4. $\frac{2\alpha}{\alpha^2 + (2\pi f)^2}$ |

| | A | B | C | D | | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|
| (a) | 3 | 1 | 4 | 2 | (b) | 2 | 4 | 1 | 3 |
| (c) | 3 | 4 | 1 | 2 | (d) | 2 | 1 | 4 | 3 |

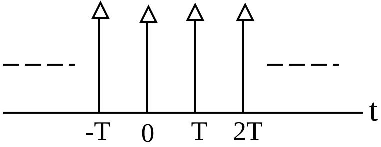
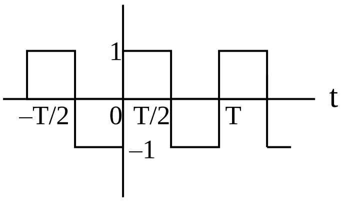
16. The F.T. of $e^{-\pi t^2}$ is $e^{-\pi f^2}$, then F.T. of $e^{-\alpha t^2}$ is____

(a) $\sqrt{\frac{\pi}{\alpha}}\, e^{-\frac{\pi^2 f^2}{\alpha}}$ (b) $\frac{1}{\alpha}\, e^{-\alpha f^2}$ (c) $\frac{1}{\sqrt{\pi\alpha}}\, e^{-\alpha\pi^2 f^2}$ (d) $\sqrt{\pi\alpha}\, e^{-f^2/\pi^2\alpha}$

17. The inverse Fourier transform of $\delta(f)$ is __

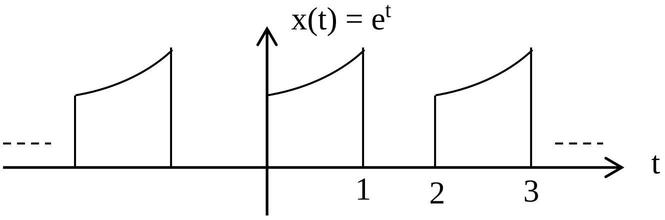
(a) u(t) (b) 1 (c) $\delta(t)$ (d) $e^{j2\pi t}$

18. Match List-I (nature of periodic function) with List-II (properties of spectrum) & select the correct answer using the codes given below :

| **List – I** | **List – II** |
|---|---|
| A. Impulse train  | 1. only even harmonics are present |
| B. Full wave rectified sine wave | 2. impulse train with strength 1/T |
| C. $\text{Sin}\left(\frac{2\pi t}{6}\right)\text{Cos}\left(\frac{4\pi t}{6}\right)$ | 3. $\alpha_3 = \frac{1}{2j}$ , $\alpha_{-3} = \frac{-1}{2j}$<br>$\alpha_1 = -\frac{1}{2j}$ , $\alpha_{-1} = \frac{1}{2j}$ |
| D.  | 4. only odd harmonics are present |
| | 5. Both even & odd harmonics are present |

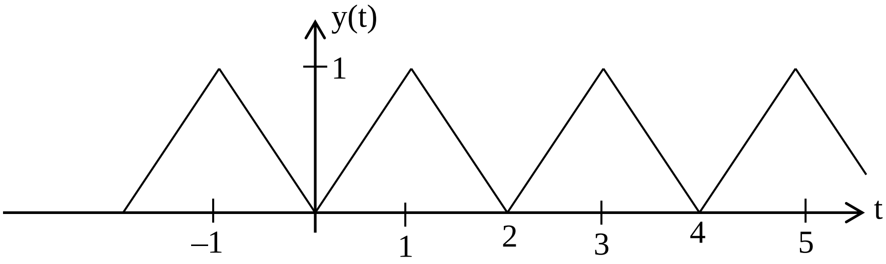
| | A | B | C | D | | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|
| (a) | 5 | 2 | 3 | 4 | (b) | 2 | 1 | 4 | 3 |
| (c) | 5 | 2 | 4 | 3 | (d) | 2 | 1 | 3 | 4 |

**2.15**. Consider the signal x(t) shown in figure. Its EFS coefficient is



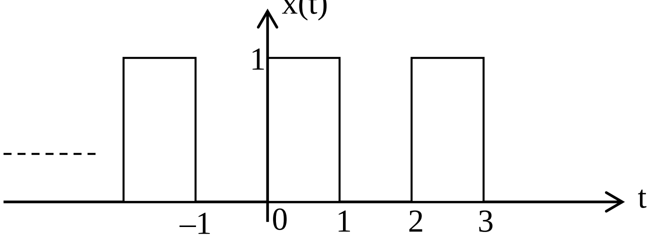
(a) $\frac{e^{1-jn\pi} - 1}{2(1 - jn\pi)}$ (b) $\frac{1 - e^{-jn\pi}}{2(1 - jn\pi)}$ (c) $\frac{\sin c(n\pi)}{1 - jn\pi}$ (d) $\frac{1 + e^{1-jn\pi}}{2(1 + jn\pi)}$

**20.** The periodic signal y(t) shown in figure contains only _______



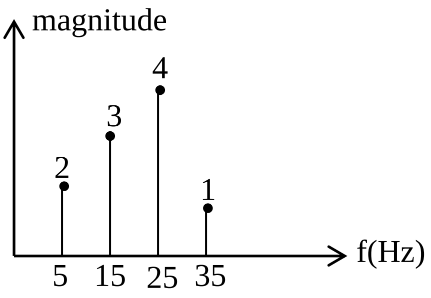
(a) d.c. & even frequency components (b) d.c. & odd frequency components
(c) d.c., even & odd frequency components (d) even & odd frequency components

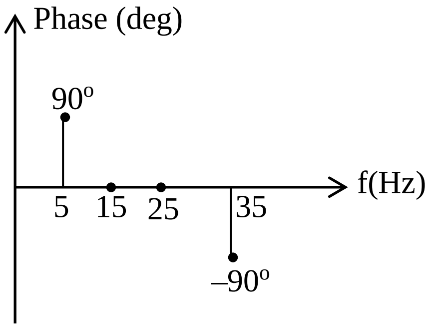
21. Consider the periodic signal x(t) shown in figure. The power in this signal is ____



(a) 0.4526 W (b) 0.5 W (c) 1 W (d) 2 W

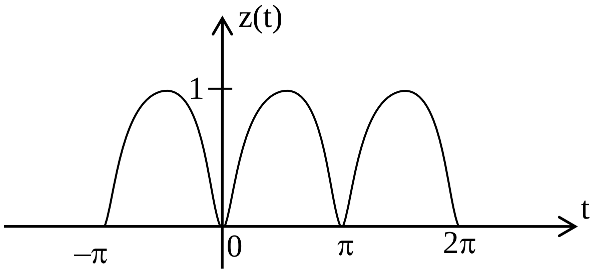
**2.14.** Consider the signal y(t) whose one-sided spectra are shown in figure. Then the signal y(t) is _______





(a) $-2\sin(10\pi t)+3\cos(30\pi t)+4\cos(50\pi t)+\sin(70\pi t)$
(b) $2\sin(10\pi t)-3\cos(30\pi t)+4\cos(50\pi t)-\sin(70\pi t)$
(c) $-2\cos(10\pi t)-3\sin(30\pi t)-4\sin(50\pi t)+\cos(70\pi t)$
(d) $2\cos(10\pi t)+3\cos(30\pi t)-4\sin(50\pi t)-\sin(70\pi t)$

**2.11.** The exponential Fourier series coefficient of a signal z(t) shown in figure is _____



(a) $\frac{2}{\pi(4n^2-1)}$ (b) $\frac{-2}{\pi(1+4n^2)}$ (c) $\frac{2}{\pi(1-4n^2)}$ (d) None

24. The input an amplifier is x(t) = cos(10πt). The gain of the amplifier is

(a) 1.25 % (b) 12.5 % (c) 0.125 % (d) 8%

**2.12.** The signal x(t) = sin(10πt) is applied to the system whose output is y(t) = $x^3$ (t). The harmonics present in the output are ____

(a) d.c. & I harmonic (b) d.c. & III harmonic

(c) I & III harmonic (d) d.c., I & III harmonic

**3.4.** The Fourier transform of a signal x(t) = δ(t+0.5) – δ (t – 0.5) is _____

(a) $2\cos(\pi f)$ (b) $\frac{\sin(\pi f)}{j}$ (c) $2j\sin(\pi f)$ (d) $-2j\ \cos(\pi f)$

**3.5**. The inverse Fourier transform of $X(f) = \frac{j3\pi f}{1+j\pi f}$

(a) $-2e^{-t/2}\ u(t)$ (b) $\frac{3}{2}\ e^{-t/2}\ u(t)$

(c) $3\delta(t)-6\ e^{-2t}\ u(t)$ (d) $3\delta(t)+\frac{3}{2}e^{-t/2}\ u(t)$

28. The complex EFS of a signal is $x(t) = \sum_{n=-\infty}^{+\infty}\frac{1}{1+j\pi n}\ e^{\frac{j3\pi nt}{2}}$. The amplitude of the third-harmonic component is ___

(a) $\frac{1}{\sqrt{1+9\pi^2}}$ (b) $\frac{2}{\sqrt{1+9\pi^2}}$ (c) $\frac{2}{\sqrt{1+3\pi^2}}$ (d) $\frac{1}{\sqrt{1+\pi^2}}$

**3.7.** The energy in the signal x(t) = 8 sinc(4t) cos(2πt) is ____

(a) 64 J (b) 32 J (c) 12 J (d) 24 J

**3.6.** The value of the integral $\int_{-\infty}^{+\infty}\text{SinC}^4(f)\ df$ is ____

(a) 1/3 (b) 2/3 (c) 4/3 (d) ∞

**3.12.** Given $H(\omega) = \frac{4}{2+j2\omega}$. Let the input be x(t) = 3 sin(2t). Then the steady state response is ______

(a) 3 sin2t (b) 4.2426 sin26

(c) 4.2426 sin(2t – $45^o$) (d) 4.2426 cos(2t+$45^o$)

**3.11.** The differential equation representation of the system $H(\omega) = \frac{1+j2\omega-\omega^2}{(1-\omega^2)\ (4-\omega^2)}$ is given by ___

(a) $\frac{d^2y(t)}{dt^2}+5\ \frac{dy(t)}{dt}+4y(t)=\frac{d^2x(t)}{dt^2}+2\frac{dx(t)}{dt}+x(t)$

(b) $\frac{d^4y(t)}{dt^4} + \frac{d^2y(t)}{dt^2} + y(t) = \frac{d^2x(t)}{dt^2} + \frac{dx(t)}{dt} + x(t)$

(c) $\frac{d^4y(t)}{dt^4} + 5\frac{d^2y(t)}{dt^2} + 4y(t) = \frac{d^2x(t)}{dt^2} + 2\frac{dx(t)}{dt} + x(t)$

(d) None of these

33. Let the input to a system with impulse response $h(t) = 2e^{-2t}\,u(t)$ be $x(t) = 3e^{-t}\,u(t)$, then the output of this system is _______

(a) $(6e^{-t} - 6e^{-2t})\,u(t)$ (b) $(6e^{-t} - e^{-2t})\,u(t)$

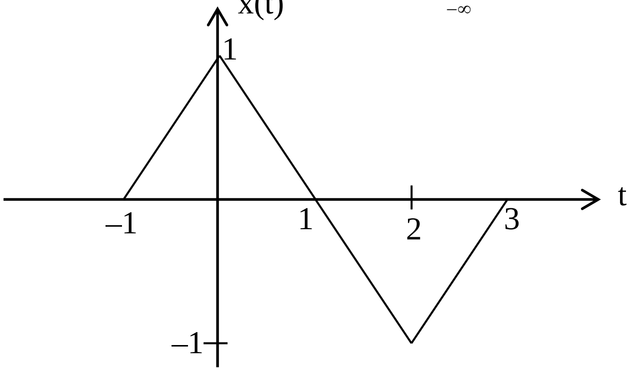
(c) $(e^{-t} + 6e^{-2t})\,u(t)$ (d) $(3e^{-2t} - 3e^{-t})\,u(t)$

34. A periodic signal has F.S. representation $x(t) \xleftrightarrow{FS_1\pi} -K\,2^{-|K|}$.

Then F.S. coefficient of $\frac{dx(t)}{dt}$ is ________

(a) $j\,K\,\pi\,2^{-|K|}$ (b) $-j\,K^2\,\pi\,2^{-|K|}$ (c) $-K\;2^{-|K|}$ (d) $-j\,K\,\pi\,2^{-|K|}$

**3.8.** For the signal shown in figure, the value of $\int_{-\infty}^{+\infty} |X(\omega)|^2\,d\omega$ is ____



(a) $\frac{2\pi}{3}$ (b) $\frac{4\pi}{3}$ (c) $\frac{8\pi}{3}$ (d) None

36. The inverse Fourier transform of $-j\mathrm{sgn}\omega$ is _______

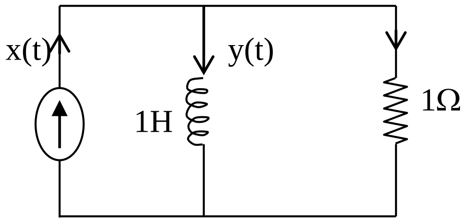
(a) $\frac{2}{\pi t}$ (b) $\frac{j}{\pi t}$ (c) $\frac{1}{\pi t}$ (d) $\frac{2j}{\pi t}$

37. Consider a continuous time ideal low pass filter whose frequency response is

$H(\omega) = \begin{cases} 1, & |\omega| \le 100 \\ 0, & |\omega| > 100 \end{cases}$. When the input to this filter is a signal x(t) with fundamental period $T=\pi/6$ & F.S. coefficient $a_K$, it is found that $x(t) \rightarrow y(t) = x(t)$. Then $a_K = 0$ is guaranteed for the values of K _______

(a) $|K| > 8$ (b) $|K| < 8$ (c) $|K| > 9$ (d) Data is not sufficient

38. Consider a causal LTI system for which a current source produces an input current x(t) & system output is considered to be current y(t) flowing through inductor as shown in figure. Then the output y(t) for an input x(t) = cost is ____



(a) $\frac{1}{\sqrt{2}}\sin(t+\frac{\pi}{4})$ (b) $\frac{1}{\sqrt{2}}\sin(t-\frac{\pi}{4})$

(c) $\frac{1}{\sqrt{2}}\mathrm{Cos}(t+\frac{\pi}{4})$ (d) $\frac{1}{\sqrt{2}}\mathrm{Cos}(t-\frac{\pi}{4})$

**3.9.** 39. The Fourier transform of $te^{-|t|}$ is _____

(a) $-\frac{4j\omega}{(1+\omega^2)^2}$ (b) $\frac{4j\omega}{(1+\omega^2)^2}$ (c) $\frac{2j\omega}{(1+\omega^2)^2}$ (d) $-\frac{2j\omega}{(1+\omega^2)^2}$

**3.10.** Consider a causal LTI system with frequency response $H(\omega)=\frac{1}{j\omega+3}$. The system output is observed to be $e^{-3t}u(t)-e^{-4t}u(t)$. Then the input to this system is ___

(a) $e^{-4t}u(t)$ (b) $e^{-3t}u(t)$ (c) $2e^{-4t}u(t)$ (d) $-e^{-3t}u(t)$

# SIGNAL SYSTEMS
# LAPLACE TRANSFORM & DTFT

4.1 The Laplace transform of $t^2u(t-1)$ is

(a) $\frac{e^{-s}}{s^2}$ (b) $\frac{e^{-s}}{s^3}$ (c) $e^{-s}\left[\frac{2}{s^3}-\frac{2}{s^2}+\frac{1}{s}\right]$ (d) None of these

4.2 The L.T. of the signal shown in fig. (1) is

(a) $\frac{s+e^{-s}}{s(1-e^{-2s})}$ (b) $\frac{s-1+e^{-s}}{s^2}$

(c) $\frac{s+1+e^{-s}}{s^2(1+e^{-2s})}$ (d) $\frac{s-1+e^{-s}}{s^2(1-e^{-2s})}$

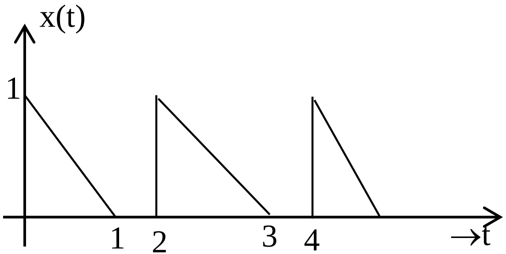


Fig (1)

03 Consider a system governed by $y''(t)+3y'(t)+2y(t) = 2x'(t)+3x(t)$. The impulse response of this system is __________.

(a) $(e^{-t}+e^{-2t})u(t)$ (b) $(e^{-t}-e^{-2t})u(t)$ (c) $(e^{-2t}-e^{-t})u(t)$ (d) None of these

04 Given $L\{x(t)\}=\frac{se^{-2s}+1}{(s+1)(s+2)}$ then x(t) is ________

(a) $[e^{-(t-2)}-e^{-(t-1)}]u(t)+\left(e^{-t}-e^{-2t}\right)u(t)$

(b) $[2e^{-2(t-2)}-e^{-(t-2)}]u(t-2)+(e^{-t}-e^{-2t})u(t)$

(c) $[e^{-2(t-2)}+e^{-(t-2)})0]u(t-2)+(e^{-t}-e^{-2t})u(t)$

(d) $[2e^{-2(t-2)}-e^{-(t-2)}]u(t)+(e^{-t}-e^{-2t})u(t)$

4.3 Consider the relaxed RL ckt shown in fig.(2) the system has an impulse response of …

(a) $\frac{1}{2}e^{-0.5t}u(t)$

(b) $\delta(t)+0.5e^{-0.5t}u(t)$

(c) $\delta(t)-0.5e^{-0.5t}u(t)$

(d) $0.25e^{-0.5t}u(t)$

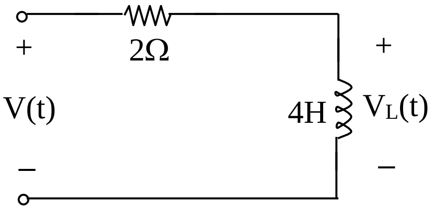


Fig (2)

06. The forced response of a system with system function $H(s)=\frac{s+8}{(s+1)(s+2)}$ to the I/P $4e^{-3t}u(t)$ is

(a) $10e^{-3t}u(t)$ (b) $-10e^{-3t}u(t)$

(c) $(14e^{-t}-24e^{-2t}+10e^{-3t})u(t)$ (d) $(14e^{-t}+24e^{-2t}-10e^{-3t})u(t)$

4.4 The Laplace transform of Cost $u\left(t-\frac{\pi}{4}\right)$ is

(a) $\frac{s}{s^2+1}e^{-\frac{s\pi}{4}}$ (b) $\frac{s}{s^2+1}e^{-\frac{s\pi}{4}}-\frac{1}{s^2+1}e^{-\frac{s\pi}{4}}$

(c) $\frac{s-1}{\sqrt{2}\ (s^2+1)}e^{-\frac{s\pi}{4}}$ (d) $\frac{s+1}{\sqrt{2}\,(s^2+1)}e^{-\frac{s\pi}{4}}$

08. If I/P – O/P relation is given by $y(t)=x(t)-2\int_{-\infty}^{t}y(\lambda)e^{-(t-\lambda)}u(t-\lambda)d\lambda$ then impulse response is given by ……..

(a) -3$e^{-3t}$u(t) (b) δ(t)-2 $e^{-3t}$u(t) (c) 2δ(t)+ $e^{-3t}$u(t) (d) $e^{-3t}$u(t)

09 The Laplace transform of the signal x(t) = $e^{2t}$u(t)+$e^{-3t}$u(-t) is ….

(a) $\frac{1}{s-2}+\frac{1}{s+3}$ (b) $\frac{1}{s-2}-\frac{1}{s+3}$ (c) $-\frac{1}{s-2}+\frac{1}{s+3}$ (d) None of these

4.5 The Laplace transform of $\sum_{K=0}^{\infty}\delta(t-KT)$is ……..

(a) $\frac{1}{e^{-ST}-1}$ (b) $\frac{1}{1+e^{-ST}}$ (c) $\frac{e^{-s}}{1-e^{-ST}}$ (d) $\frac{1}{1-e^{-ST}}$

11. The time domain signal corresponding to $\text{LT}\,x(s)=\frac{2s+4}{s^2+4s+3}$, -3<Re{s}<-1 is ….

(a) –$e^{-t}$u(-t)+$e^{-3t}$u(t) (b) –$e^{-t}$u(t)+$e^{-3t}$u(t)

(c) –$e^{-t}$u(-t)-$e^{-3t}$u(-t) (d) None of these

4.14 The time-domain signal corresponding to $x(s)=\frac{s^3+2s^2+6}{s^2+3s}$, Re{s}>0 is ….

(a) -δ′(t)+(2+$e^{-3t}$)u(t) (b) -δ′(t)-(2-$e^{-3t}$)u(t)

(c) δ′(t)-δ(t)+(2+$e^{-3t}$)u(t) (d) δ′(t)+δ(t)-2u(t)- $e^{-3t}$u(t)

13. The O/P of a continuous – time LTI system is found to be 2$e^{-3t}$u(t) when the I/P is u(t). The O/P when the I/P is $e^{-t}$u(t) is

(a) (-$e^{-t}$-$e^{-3t}$)u(t) (b) (-$e^{-t}$+3$e^{-3t}$)u(t) (c) (-$e^{-t}$-3$e^{-3t}$)u(t) (d) ($e^{-t}$+3$e^{-3t}$)u(t)

4.6 The step response of a continuous-time LTI system is given by (1-$e^{-t}$)u(t). for a certain unknown I/P, O/P is observed to be (2-3$e^{-t}$+$e^{-3t}$)u(t). then I/P is …

(a) (2+2$e^{-3t}$)u(t) (b) 2(1-$e^{-3t}$)u(t) (c) 2($e^{-3t}$-1)u(t) (d) none of these

4.7 The solution of the equation $y(t)=e^t\left[1+\int_0^t e^{-\tau}y(\tau)d\tau\right]t\geq 0$ is …….

(a) $e^{-2t}$, t ≥ 0 (b) –$e^{-2t}$, t < 0 (c) $e^{2t}$, t≥ 0 (d) –$e^{2t}$, t ≤ 0

16. The solution of the differential equation y″(t) - y′(t)-6y(t) = $e^t$ with initial conditions y(0) = 1 & y′(0) = 0 is ….. (for t ≥0)

(a) $\frac{1}{6}e^t-\frac{2}{3}e^{-2t}+\frac{1}{2}e^{3t}$ (b) $-\frac{1}{6}e^t+\frac{2}{3}e^{-2t}+\frac{1}{2}e^{3t}$

(c) $\frac{1}{6}e^{-t}+\frac{2}{3}e^{2t}-\frac{1}{2}e^{-3t}$ (d) $-\frac{1}{6}e^t-\frac{2}{3}e^{-2t}+\frac{1}{2}e^{3t}$

4.15 The minimum-phase transfer function corresponding to $|H(\omega)|^2 = \dfrac{4(9+\omega^2)}{4+5\omega^2+\omega4}$ is ….

(a) $\dfrac{2(s+3)}{(s+1)(s+2)}$ (b) $\dfrac{4(s+3)}{(s+1)(s+2)}$ (c) $\dfrac{4(s+3)}{(s+1)(s-2)}$ (d) $\dfrac{4(s+3)}{(s-1)(s+2)}$

18. The final value of $F(s) = \dfrac{1}{(s+j)(s-j)}$ is …..

(a) 1 (b) 0 (c) -1 (d) Not defined

4.8 If $L\{f(t)\} = \dfrac{-s+3}{s-1}$. The initial value of f(t) is given by …..

(a) 3 (b) -3 (c) 2 (d) 0

20 Consider a continuous-time LTI system for which the I/P x(t) & O/P y(t) are related by $y''(t)+y'(t)-2y(t) = x(t)$ for the system to be stable impulse response is ……

(a) $-\frac{1}{3}(e^{-2t}-e^{t})u(t)$ (b) $\frac{1}{3}e^{-2t}u(-t)-\frac{1}{3}e^{t}u(-t)$

(c) $-\frac{1}{3}e^{-2t}u(t)-\frac{1}{3}e^{t}u(-t)$ (d) $\frac{1}{3}e^{-2t}u(t)+\frac{1}{3}e^{t}u(-t)$

21. The transfer function of a linear system is the …..

(a) ratio of O/P, $V_0(t)$ & I/P, $V_i(t)$

(b) ratio of derivatives of the O/P and the I/P

(c) ratio of the LT of the O/P & that of the I/P with all initial conditions zero

(d) none of these

4.9 The final value theorem is used to find the …….

(a) steady state value of the system O/P

(b) initial value of the system O/P

(c) transient behaviour of the system O/P

(d) none of these

4.10 A system is represented by $\dfrac{dy}{dx} + 2y(t) = 4t\,u(t)$ the ramp component in the forced response will be …….

(a) t u(t) (b) 2t u(t) (c) 3t u(t) (d) 4t u(t)

4.13 The inverse Laplace transform of $\left(\dfrac{s+3}{s^2+9}\right)e^{s}$ is …….

(a) cos 3 (t+1) + 3 sin 3(t-1) (b) sin 3(t+1)+3 cos 3(t-1)

(c) sin 3 (t+1) + cos 3(t+1) (d) sin 3 (t-1)+ cos 3 (t-1)

25. The unilateral Laplace transform of $e^{-t}(t-2)u(t-2)$ is ….

(a) $\dfrac{e^{-2(s+1)}}{(s+1)^2}$ (b) $\dfrac{e^{-2s}}{(s+1)^2}$ (c) $\dfrac{e^{-s}}{s^2(s+1)}$ (d) $\dfrac{e^{-2s}}{s^2(s+1)}$

26. The initial and final value of $x(s) = \frac{-2e^{-5s}}{s(s+2)}$ are … respectively

(a) -1 & ∞ (b) 0 & ∞ (c) 0 & -1 (d) -1 & 0

27 The inverse Laplace transform of $x(s) = \frac{4s^2 + 15s + 8}{(s+2)^2(s-1)}$ if the Fourier transform of x(t) exists is …..

(a) $e^{-2t}u(t)+2te^{-2t}u(t)-3e^{t}u(-t)$ (b) $e^{-2t}u(-t)-2te^{-2t}u(t)+3e^{t}u(t)$

(c) $-e^{-2t}u(t)-2te^{-2t}u(-t)+3e^{t}u(-t)$ (d) None of these

28. Given cos (2t) u(t) ↔ x(s), then time-domain signal corresponding to x(2s) is …..

(a) cos 2t u(t-1) (b) $\frac{1}{2}\cos u(t)$ (c) cos t u(t) (d) $\cos\left(\frac{t}{2}\right)u(t)$

4.11 The L.T. of the signal f(t) shown in fig (3) are ………..

(a) $\frac{1+3e^{-2s}-2e^{-3s}}{s^2}$

(b) $\frac{1-3e^{-2s}+2e^{-3s}}{s^2}$

(c) $\frac{1-3e^{2s}-2e^{-3s}}{s^2}$

(d) $\frac{1-3e^{2s}+2e^{3s}}{s^2}$

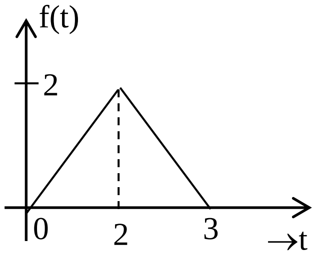


Fig (3)

30 For an LTI system with transfer function $H(s) = \frac{s+5}{s^2+4s+3}$. The system response when the I/P is $e^{-2t}$ u(t) is ……

(a) $(-2e^{-t}+3e^{-2t}+e^{3t})u(t)$ (b) $(2e^{-t}+e^{-2t}+3e^{-3t})$ u(t)

(c) $(2e^{-t}-3e^{-2t}+e^{-3t})u(t)$ (d) None of these

31 For the system shown in fig (4), the system function is …

(a) $\frac{7s^2+37s+51}{(s+2)(s+3)^2}$

(b) $\frac{5s+2}{(s+2)(s+3)^2}$

(c) $\frac{7s^2-37s+51}{(s+2)(s+3)^2}$

(d) None of these

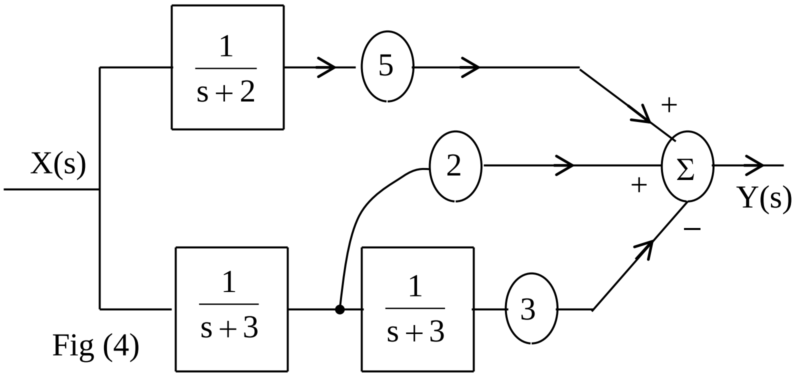


Fig (4)

32 The Laplace transform of $e^{-t}$ u(t-τ) is …

(a) $\frac{e^{-\tau}}{s+1}$ (b) $\frac{e^{-s}}{s(s+1)}$ (c) $\frac{e^{-(s+1)\tau}}{s+1}$ (d) $\frac{e^{-(s-1)\tau}}{s+1}$

33. The DTFT of $x(n) = \alpha^n, 0 \le n < N$ is …..

(a) $\frac{1-\alpha e^{-j\omega N}}{1-\alpha e^{-j\omega}}$ (b) $\frac{1+\alpha^N e^{-j\omega N}}{1-\alpha e^{-j\omega}}$ (c) $\frac{1-\alpha^N e^{-j\omega N}}{1-\alpha e^{-j\omega}}$ (d) None of these

34. Let $x(\omega) \Leftrightarrow (0.5)^n u(n)$ then time signal corresponding to $x^2(\omega)$ is ….

(a) $n(0.5)^n u(n)$ (b) $(n+1)(0.5)^n u(n)$ (c) $(n+1)(0.5)^{n+1} u(n+1)$ (d) $n(0.5)^{n+1}u(n+1)$

5.16 Let the impulse response $h(n) = \left\{\frac{1}{4}, \underset{\uparrow}{\frac{1}{2}}, \frac{1}{4}\right\}$ The type of filter is ……

(a) LPF (b) HPF (c) BSF (d) APF

5.15 Let the impulse response of a discrete-time system be given by $h(n) = \frac{1}{\pi n}\sin\left(\frac{\pi n}{4}\right)$.

Then the O/P for an excitation of $\frac{1}{\pi n}\sin\left(\frac{\pi n}{8}\right)$ is …..

(a) $\frac{1}{\pi n}\sin\left(\frac{\pi n}{4}\right)$ (b) $\frac{1}{\pi n}\cos\left(\frac{\pi n}{4}\right)$ (c) $\frac{1}{\pi n}\sin\left(\frac{\pi n}{8}\right)$ (d) $\frac{1}{\pi n}\cos\left(\frac{\pi n}{8}\right)$

5.17 A casual LTI system is described by the difference equation y(n) – 5y(n-1)+6y(n-2) = 2x(n-1). The step response of the system is ……..

(a) $[-8(2)^{(n-1)}+9(3)^{(n-1)}+1]u(n)$ (b) $[8(2)^{(n-1)}-9(3)^{(n-1)}+1]u(n-1)$

(c) $2[3^n-2^n]\,u(n)$ (d) $2[3^{n-1}-2^{n-1}]\,u(n)$

5.16 Consider a system with I/P x(n) & O/P y(n) that satisfy the difference equation y(n) = ny(n-1)+x(n). The system is casual. If x(n) = δ(n) then y(n) is ……..

(a) n!u(n) (b) (n-1)!u(n) (c) $\left(\frac{1}{n}\right)^n u(n)$ (d) none of these

40. The DTFT of x[n] = 1 ∀n is …..

(a) δ(ω) (b) 2πδ(ω+2π) (c) $\sum_{K=-\infty}^{+\infty} 2\pi\delta(\omega+2\pi K)$ (d) $\sum_{K=-\infty}^{+\infty} -\delta(\omega+2\pi K)$

# SIGNAL SYSTEMS
# Z - TRANSFORMS

5.1 The Z-transform of a signal is given by $C(z) = \frac{1}{4}\frac{z^{-1}(1-z^{-4})}{(1-z^{-1})^2}$. Its final value is ….

(a) $\frac{1}{4}$ (b) 0 (c) 1 (d) $\infty$

5.2 The ZT of the sequence $X[n] = \begin{cases} n, & 0 \le n \le N-1 \\ N, & N \le n \end{cases}$ is .

(a) $\frac{Z^{-1}(1+Z^{-N})}{(1-Z^{-1})}$ (b) $\frac{(1-Z^{-N})}{Z^{-1}(1-Z^{-1})^2}$

(c) $\frac{Z^{-1}(1-Z^{-N})}{(1-Z^{-1})^2}$ (d) $\frac{Z^{-1}(1-Z^{-N+1})}{(1-Z^{-1})}$

03. The ROC of ZT for the sequence x[n] = u[n+10]-u[n+5] is ….
(a) $|z| < 1$ (b) $0 \le |z| \le \infty$ (c) $|z| > 1$ (d) $|z| < \infty$

5.18 Given ZT $x(z) = \frac{1}{\left(1-\frac{1}{5}Z^{-1}\right)\left(1+3Z^{-1}\right)}, \frac{1}{5} < |z| < 3$ and system function

$H(z) = \frac{1+3Z^{-1}}{1+\frac{1}{3}Z^{-1}}, |Z| > \frac{1}{3}$ then ROC of ZT O/P is

(a) $\frac{1}{3} < |Z| < 3$ (b) $|Z| < 3$ (c) $|Z| > \frac{1}{3}$ (d) None of these

5.19 The Z.t. of x[n] = $na^{n-1}$ u[n] is ….

(a) $\frac{aZ}{(Z-a)^2} |Z| > a|$ (b) $\frac{Z}{(Z-a)^2}, |Z| > |a|$

(c) $\frac{Z}{(Z-a)^2}, |Z| < |a|$ (d) None of these

5.3 Given the signal x[n] is having Z.T. $X(Z) = Z^2\left(1-\frac{1}{2}Z^{-1}\right)\left(1-Z^{-1}\right)\left(1+2Z^{-1}\right)$, 0 < |Z| < ∞. Then the value of this signal at n = 2 is ………

(a) 0 (b) -1 (c) $-\frac{5}{2}$ (d) $\frac{1}{2}$

08 Given $X(Z) = \log\left(\frac{1}{1-aZ^{-1}}\right), |Z| > |a|$. Then inverse Z.T. is …….

(a) $\frac{a^n}{n}u(n-1)$ (b) $\frac{a^{n+1}}{n}u(n-1)$ (c) $\frac{a^{n-1}}{n}u(n)$ (d) $\frac{a^{n-1}}{n}u(n-1)$

09. For all-pass magnitude response of the transfer function H(z) of a discrete time system, following must be satisfied

(a) zeros must be negatives of the poles
(b) zeros must be reciprocal of the poles
(c) zeros must be on the real axis only
(d) zeros must be on the unit \$\$\$ only

5.4 w sequences $x_1[n]$ & $x_2[n]$are related by $x_2[n] = x_1[-n]$. the corresponding Z.T. satisfy following relation

(a) $X_2(z) = X_1(Z^*)$
(b) $X_2(z) = X_1^*(Z)$
(c) $X_2(z) = X_1^*(Z^{-1})$
(d) $X_2(z) = X_1(Z^{-1})$

11. The ROC of Z.T's of u[n] & u[-n-1]are ….. respectively

(a) both |Z|>1
(b) both |Z| < 1
(c) |Z| < 1 & |Z| > 1
(d) |Z| > 1 & |Z| < 1

12. The Z.T. of x[n] is X(z). The Z.T. of new sequence $x_1(n) = x(Mn)$ n = 0, ±1, ±2, …. Would be ________

(a) $X(Z^m)$
(b) $X(m^Z)$
(c) $X\left(Z\frac{1}{m}\right)$
(d) None of these

13. If x[n] is a left-sided sequence and if the circle |Z| = $s_0$ is in ROC, then all values of Z for which 0 < |Z|<$s_0$ will be

(a) in the ROC
(b) outside ROC
(c) in annular region
(d) none of these

14. The inverse of $X(Z) = e^{a/z}$ |Z|>0 is …..

(a) $\frac{a^n}{n!}\forall n$
(b) $\frac{a^{n-1}}{(n-1)!}u(n)$
(c) $\frac{a^n}{n!}u(n)$
(d) $\frac{a^{n+1}}{(n+1)!}u[n-1]$

5.5 The initial & final values of x[n] if $X(z) = \frac{2Z\left(Z-\frac{5}{12}\right)}{\left(Z-\frac{1}{2}\right)\left(Z-\frac{1}{3}\right)}, |Z| > \frac{1}{2}$ is …. respectively

(a) 0 & 2
(b) 2 & 0
(c) 0 & 1
(d) 1 & 0

16. Given $X(Z) = \frac{Z^{10}}{\left(Z-\frac{1}{2}\right)\left(Z-\frac{3}{2}\right)^{10}\left(Z+\frac{3}{2}\right)^{2}\left(Z+\frac{5}{2}\right)\left(Z+\frac{7}{2}\right)}$. This system is table then x[n] at n = -8 is ………

(a) $\frac{1}{24}$
(b) $\frac{1}{48}$
(c) $\frac{1}{96}$
(d) $\frac{1}{12}$

5.6 Given $X(Z) = \frac{3}{Z-\frac{1}{4}-\frac{1}{8}Z^{-1}}$ x[n] is absolutely summable. The x[n] is ….

(a) $4\left(\frac{1}{2}\right)^n u[n] - 4\left(-\frac{1}{4}\right)^n u[n]$
(b) $4\left(\frac{1}{2}\right)^n u[n] + 4\left(-\frac{1}{4}\right)^n u[n]$
(c) $4\left(\frac{1}{2}\right)^n u[-n-1] - 4\left(-\frac{1}{4}\right)^n u[n]$
(d) $4\left(\frac{1}{2}\right)^n u[n] - 4\left(-\frac{1}{4}\right)^n u[-n-1]$

18. Given system function $H(Z)=\dfrac{Z}{(Z-2)(Z+3)}$ / This system is stable then impulse response is …..

(a) –$(2)^n$u[n]+$(-3)^n$u[-n-1] (b) –$(2)^n$u[n]+$(-3)^n$u[n]

(c) –$(2)^n$u[-n-1]+$(-3)^n$u[-n-1] (d) $(2)^n$u[-n-1]-$(-3)^n$u[-n-1]

19. An LTI system is characteristics by system fn. $H(Z)=\dfrac{3-4Z^{-1}}{1-3.5Z^{-1}+1.5Z^{-2}}$. For this system to be stable & causal, impulse response is …………

(a) $\left(\dfrac{1}{2}\right)^n u[n]-2(3)^n u[-n-1]$ (b) $\left(\dfrac{1}{2}\right)^n u[n]+2(3)^n u[n]$

(c) $-\left(\dfrac{1}{2}\right)^n u[n]+2(3)^n u[-n-1]$ (d) None of these

20. The Z.T. of the $2^{n+1}$ u(n-1) is ……

(a) $\dfrac{4}{Z-2}$ (b) $\dfrac{4Z}{Z-2}$ (c) $\dfrac{4Z^{-1}}{1+2Z^{-1}}$ (d) None of these

5.7 The casual signal corresponding to $X(Z)=\dfrac{Z^{-1}}{1+Z^{-3}}$ is ……..

(a) $\{\underset{\uparrow}{0},\ 1,\ 0,\ 0,\ -1,\ 0\}$ (b) $\{1,\ 0,\ \underset{\uparrow}{-1},\ 0,\ 1,\ 0\}$

(c) $\{0,\ 0,\ \underset{\uparrow}{-1},\ 0,\ 1,\ 0\}$ (d) None

22. The Z.T. of a periodic sequence x[n] = {0, 1, -2, 0, 1, -2m ….} is

(a) $\dfrac{Z^{-1}-2Z^{-2}}{1-Z^{-3}}$ (b) $\dfrac{Z^{-1}+2Z^{-2}}{1+Z^{-2}}$ (c) $\dfrac{Z^{-1}-2Z^{-2}}{1+Z^{-3}}$ (d) None

23. Let $H(Z)=\dfrac{3Z}{Z-0.4}$. The zero-state response of the system to x[n] = $(0.4)^n$u[n] will be …

(a) 3(n+1)(0.4) (b) 3n$(0.4)^n$u[n] (c) 3(n+1) $(0.4)^n$u(n) (d) 3n$(0.4)^{n-1}$u(n01)

5.20 A linear, shift – invariant, filter has the unit pulse response h(n) = $\left(\dfrac{1}{4}\right)^n u[n-4]$. The response to the I/P x(n) = h(n) is ….

(a) $\left(\dfrac{1}{4}\right)^n u(n-8)$ (b) $\left(\dfrac{1}{4}\right)^n (n-7)u(n-8)$

(c) $n\left(\dfrac{1}{4}\right)^n u(n-8)$ (d) $\left(\dfrac{1}{4}\right)^n (n-8)u(n-8)$

25. Given $X(Z) = eaZ^{-1}$ where a real constant the value at n = 5 is ….

(a) $\frac{a^4}{120}$ (b) $\frac{a^5}{24}$ (c) $\frac{a^5}{120}$ (d) None of these

26. Given $2^n u(n) \Leftrightarrow x(z)$. then time – signal corresponding to z(z) = x(-z) is ….

(a) $(-2)^n u(n)$ (b) $(-2)^n u(-n)$ (c) $2^{-n} u(n)$ (d) $2^{-n} u(-n)$

27. Let y(n) = 0.5 y(n-1) + x(n). Then steady state response to x(n) = 10 cos $\left(\frac{n\pi}{2} + 60°\right)$ is

(a) $8.9443\,\mathrm{Cos}\left(\frac{n\pi}{2} + 33.4°\right)$ (b) $8.9443\,\mathrm{Cos}\left(\frac{n\pi}{2} + 60°\right)$

(c) $0.8944\,\mathrm{Cos}\left(\frac{n\pi}{2} - 33.4°\right)$ (d) None of these

28. The inverse Z.T. of $X(Z) = \frac{Z^{3-1}}{Z^{5(Z-1)}}$ is …….

(a) u(n-3)-u(n-6) (b) u(n)-u(n-6) (c) u(n-3)-u(n-5) (d) None of these

29. The IZT of $X(Z) = \frac{1 - Z^{-1} + Z^{-2}}{\left(1 - \frac{1}{2}Z^{-1}\right)\left(1 - 2Z^{-1}\right)\left(1 - Z^{-1}\right)}$ with ROC |<|Z |Z|<2 then the signal is

(a) $\left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n) - 2u(n)$

(b) $\left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n-1) + 2u(n)$

(c) $\left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n-1) - 2u(-n+1)$

(d) $\left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n-1) - 2u(n)$

30. For the above problem (29th bit) ROC is change to $\frac{1}{2} <| Z |<|$ then the signal is

(a) $\left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n-1) + 2u(-n-1)$

(b) $\left(\frac{1}{2}\right)^n u(n) + 2(2)^n u(-n-1) - 2u(-n-1)$

(c) $\left(\frac{1}{2}\right)^n u(n) + 2(2)^n u(-n-1) + 2u(-n)$

(d) $\left(\frac{1}{2}\right)^{n-1} u(n) - 2(2)^n u(-n-1) + 2u(-n-1)$

31. If DTFT id defined, then the signal for $X(Z) = \frac{3-3Z^{-1}}{\left(1-\frac{1}{2}Z^{-1}\right)\left(1-Z^{-1}\right)}$ IS

(a) $\left(\frac{1}{2}\right)^n u(n) + 2(2)^n u(n)$ (b) $\left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n-1)$

(c) $\left(\frac{1}{2}\right)^n u(n) - (2)^n u(-n-1)$ (d) $\left(\frac{1}{2}\right)^n u(n) + 2(2)^n u(-n-1)$

5.14. A system is described by y[n] – y[n-1]+ $\frac{1}{4}[n-2] = x[n] + \frac{1}{4}x[n-1] - \frac{1}{8}x[n-2]$ then the inverse system is ……

(a) stable & noncausal (b) unstable & causal

(c) unstable & noncausal (d) stable & causal

5.9 The first 4 samples of $X(Z) = \frac{Z^2-1}{Z^3+2Z+4}$ are …..

(a) {0, -1, -3, 0} (b) {0, 1, 0, -3} (c) {1, -3, 0, -4} (d) {1, 0, -3, -4}

5.8 Given $X(Z) = \frac{1+\frac{8}{9}Z^{-1}}{1-\frac{16}{9}Z^{-1}+\frac{64}{81}Z^{-2}}, |Z| > \frac{8}{9}$. Then the type of filter is …..

(a) HPF (b) LPF (c) BPF (d) APF

35 Consider $x(n) = \begin{cases} 1, & 0 \le n \le 5 \\ 0, & \text{elsewhere} \end{cases}$ let g(n) = x(n)- x(n-1). Then Z.T. of g(n) is ……..

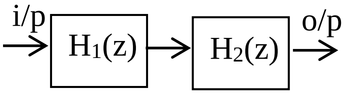
(a) $\frac{1-Z^{-5}}{1-Z^{-1}}; |Z| > 1$ (b) $\frac{Z^6-1}{Z^{-1}}; |Z| > 1$

(c) 1-$Z^{-6}$; |Z| > 0 (d) 1+$Z^{-6}$; |Z| > 0

5.10 Let x[n] be a signal whose rational Z.T. X(Z) contains a pole at $Z = \frac{1}{2}$. Given that $x_1[n] = \left(\frac{1}{4}\right)^n x[n]$ is absolutely summable & $x_2(n) = \left(\frac{1}{8}\right)^n x(n)$ is not absolutely summable. Then x[n] is …..

(a) left-sided (b) right-sided (c) two-sided (d) none of these

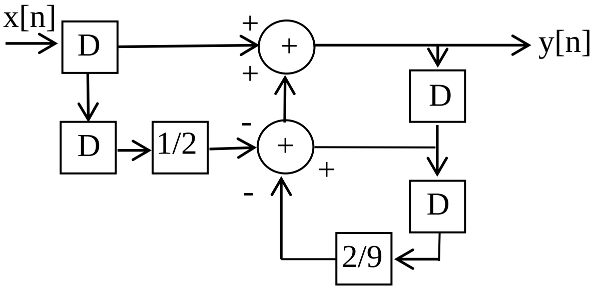
37 Consider the system shown in fig. If O/P is equal to I/P with a delay of 2 units. If transfer function of first system is $H_1(Z) = \frac{Z-0.5}{Z-0.8}$, then transfer function of second system is ….



(a) $\frac{Z^{-2}-0.2Z^{-3}}{1-0.4Z^{-1}}$ (b) $\frac{Z^{-2}-0.8Z^{-3}}{1-0.5Z^{-1}}$ (c) $\frac{Z^{-1}-0.2Z^{-3}}{1-0.4Z^{-1}}$ (d) $\frac{Z^{-2}+0.8Z^{-3}}{1+0.5Z^{-1}}$

5.11 Given the transfer function $H_1(Z) = (1+1.5Z^{-1}-Z^{-2})$ & $H_2(Z)= Z^2+1.5Z^{-1}$, then
(a) poles & zeros of the function will be the same
(b) poles of the functions will be identical but not zeros
(c) zeros of the functions will be identical but not poles
(d) neither poles nor zeros of the 2 functions will be identical

5.12 For the system shown in fig, relationship between I/P x[n] & O/P y[n] is …
{D represents delay}



(a) y[n] – y[n-1]+$\frac{2}{9}y[n-2]=x[n-1]-\frac{1}{2}x[n-2]$
(b) y[n] + y[n-1]+$\frac{2}{9}y[n-2]=x[n-1[+\frac{1}{2}x[n-2]$
(c) y[n] – y[n-1]-$\frac{2}{9}y[n-2]=x[n-1]+\frac{1}{2}x[n-2]$
(d) None of these

5.13 The Z-transform of $x(n)=\left(\frac{2}{3}\right)^n u[n+2] is$ ……..

(a) $\frac{Z^3}{Z-\frac{2}{3}} \quad |Z|>\frac{2}{3}$ (b) $\frac{9}{4}\left[\frac{Z^3}{Z-\frac{2}{3}}\right] \quad |Z|>\frac{2}{3}$

(c) $\frac{Z^2}{Z\left(Z-\frac{2}{3}\right)} \quad |Z|>\frac{2}{3}$ (d) $\frac{\frac{9}{4}}{z\left(z-\frac{2}{3}\right)} \quad |Z|>\frac{2}{3}$