MADE EASY PUBLICATIONS

POSTAL BOOK PACKAGE 2025

CONTENTS

ELECTRICAL ENGINEERING

Objective Practice Sets

Signals and Systems

1 CHAPTER
Basics of Signals and Systems

MCQ and NAT Questions

Q.1 If a function $f(t)\,u(t)$ is shifted to right side by t_0, then the function can be expressed as
(a) $f(t-t_0)\,u(t)$
(b) $f(t)\,u(t-t_0)$
(c) $f(t-t_0)\,u(t-t_0)$
(d) $f(t+t_0)\,u(t+t_0)$

Q.2 If $a(n)$ is the response of a linear, time-invariant, discrete-time system to a unit step input, then the response of the same system to a unit impulse input is
(a) $\frac{d}{dn}[a(n)]$
(b) $na(n)$
(c) $a(n)-a(n-1)$
(d) $a(n+1)-2a(n)+a(n-1)$

Q.3 The unit impulse response of a linear time invariant system is the unit step function $u(t)$. For $t>0$, the response of the system to an excitation $e^{-at}u(t)$, $a>0$ will be
(a) ae^{-at} (b) $(1/a)(1-e^{-at})$
(c) $a(1-e^{-at})$ (d) $1-e^{-at}$

Q.4 The unit step response of a system is given by $(1-e^{-at})\,u(t)$, the impulse response is given by
(a) $e^{\alpha t}u(t)$ (b) $e^{-\alpha t}u(t)$
(c) $\frac{1}{\alpha}e^{-\alpha t}u(t)$ (d) $\alpha e^{-\alpha t}u(t)$

Q.5 A function $f(t)$ is an even function, if for all values of t
(a) $f(t)=f(-t)$ (b) $f(t)=-f(-t)$
(c) $f(t)=f(t+T/2)$ (d) $f(t)=-f(t+T/2)$
(T is the time-period of the function)

Q.6 The function $\delta(2n)$ is equal to
(a) $\delta(n)$ (b) $\frac{1}{2}\delta(n)$
(c) $2\delta(n)$ (d) $2\delta\left(\frac{n}{2}\right)$

Q.7 If $x_1(t)=2\sin\pi t+\cos 4\pi t$ and $x_2(t)=\sin 5\pi t+3\sin 13\pi t$, then
(a) $x_1(t)$ and $x_2(t)$ both are periodic.
(b) $x_1(t)$ and $x_2(t)$ both are not periodic.
(c) $x_1(t)$ is periodic, but $x_2(t)$ is not periodic.
(d) $x_1(t)$ is not periodic, but $x_2(t)$ is periodic.

Q.8 Energy signals are the signals with
(a) $0<E<\infty$, $P=0$ (b) $0<E<\infty$, $P=\infty$
(c) $0<P<\infty$, $E=\infty$ (d) $0<P<\infty$, $E=0$

Q.9 Power signals are the signals with
(a) $0<E<\infty$, $P=0$
(b) $0<E<\infty$, $P=\infty$
(c) $0<P<\infty$, $E=\infty$
(d) $0<P<\infty$, $E=0$

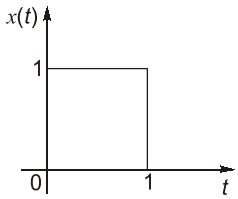
Q.10 A signum function is
(a) zero for t greater than zero
(b) zero of t less than zero
(c) unity for t less than zero
(d) $2\,u(t)-1$

Q.11 The average value of the waveform $x(t)=4\cos 4t-5\sin 5t$ is
(a) 0 (b) $-\left(\frac{2}{\pi}\right)$
(c) $\frac{2}{\pi}$ (d) $\frac{20}{\pi}$

Q.12 If two signals are given as,
$$x_1(t)=e^{jt} \text{ and } x_2(t)=e^{t(j+1)}$$
Then which one of the following statements is correct?
(a) Both $x_1(t)$ and $x_2(t)$ are periodic
(b) Only $x_1(t)$ is periodic
(c) Only $x_2(t)$ is periodic
(d) Neither $x_1(t)$ nor $x_2(t)$ is periodic

Q.13 If a continuous time signal $x(t)$ can take on any value in the continuous interval $(-\infty,\infty)$, it is called
(a) Deterministic signal (b) Random signal
(c) Analog signal (d) Digital signal

Q.34 An LTI system has step response $(1 - e^{-t})\,u(t)$. The response of the system for following input $x(t)$ at $t = 2$ is_____.



Multiple Select Questions (MSQ)

Q.35 For which of the following function(s) the time scaling operation will effect its original nature of the function:

(a) $\delta(t)$
(b) $u(t)$
(c) $r(t)$
(d) A rectangular pulse within finite duration.

Q.36 A discrete system with input $x[n]$ and output $y[n]$ are related by

$$y[n] = \sum_{n=-\infty}^{\infty} x[n]e^{-j\omega n}$$

The system is

(a) unstable (b) stable
(c) time variant (d) time invariant

Q.37 Consider a continuous time signal $x(t) = 2\cos\left(\frac{\pi t}{4}\right) * \delta\left(\frac{t}{2} - 1\right)$. Then for which value of 't', signal $x(t)$ is zero.

(a) $t = 0$ (b) $t = 2$
(c) $t = 1$ (d) $t = 4$

Q.38 Consider a discrete-time periodic signal $x[n] = \begin{cases} 1, & 0 \le n \le 7 \\ 0, & 8 \le n \le 9 \end{cases}$ with period of $N = 10$. A function $y[n]$ is defined as $y[n] = \xi[n] - \xi[n-1]$, then the correct options regarding $y[n]$ are

(a) period $N = 10$
(b) period $N = 8$
(c) $y[n] = \{1,0,0,0,0,0,0,0,-1,0\}$ for one time period
(d) $y[n] = \{1,0,0,0,0,0,-1,0\}$ for one time period

■■■■

Answers Basics of Signals and Systems

1. (c)	2. (c)	3. (b)	4. (d)	5. (a)	6. (a)	7. (a)	8. (a)	9. (c)
10. (d)	11. (a)	12. (b)	13. (c)	14. (d)	15. (d)	16. (d)	17. (c)	18. (a)
19. (b)	20. (b)	21. (b)	22. (b)	23. (b)	24. (d)	25. (a)	26. (a)	27. (c)
28. (a)	29. (8)	30. (4)	31. (4)	32. (24)	33. (0)	34. (0.232)	35. (a,c,d)	36. (b,c)
37. (a,d)	38. (a,c)							

Explanations Basics of Signals and Systems

1. (c)

Since $f(t)u(t) = f(t)$ for $t > 0$ also we know $u(t - t_0) = 1$, for $t > t_0$

Here in right side shifting that means $t_0 > 0$

$\therefore$ by property on shifting right side,

$$f(t)\,u(t) = \xrightarrow[\text{shifting RHS by } t_0]{\text{on}} f(t - t_0)\,u(t - t_0)$$

2. (c)

For discrete time system,

$$\delta(n) = u(n) - u(n-1)$$

For continuous time system,

$$\delta(t) = \frac{d}{dt}u(t)$$

3. (b)

Since, for unit impulse, response is unit step i.e. transfer function is integrator.

$$\therefore \quad y(t) = \int_{-\infty}^{t} e^{-at}\,u(t) \qquad u(t) = \begin{cases} 1, & t > 0 \\ 0, & \text{elsewhere} \end{cases}$$

$$= \int_{0}^{t} e^{-at}\,dt = \frac{1}{a}(1 - e^{-at})$$

2 CHAPTER
Linear Time Invariant Systems

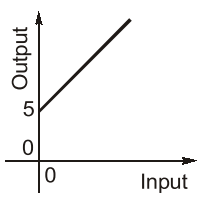
MCQ and NAT Questions

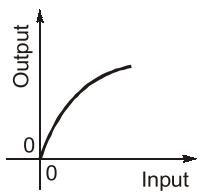
Q.1 A function $f(\cdot)$ is linear under the condition(s)
(a) $f(x_1 + x_2) = f(x_1) + f(x_2)$ only
(b) $f(kx) = kf(x)$ only
(c) $f(x_1 + x_2) = f(x_1) + f(x_2)$ and $f(kx) = kf(x)$
(d) $f(x_1 + x_2) = f(x_1) + f(x_2)$ or $f(kx) = kf(x)$

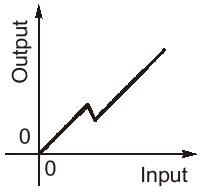
Q.2 Which one of the following systems is a causal system? [$y(t)$ is output and $u(t)$ is a input step functions].
(a) $y(t) = \sin[u(t + 3)]$
(b) $y(t) = 5u(t) + 3u(t - 1)$
(c) $y(t) = 5u(t) + 3u(t + 1)$
(d) $y(t) = \sin[u(t - 3)] + \sin[u(t + 3)]$

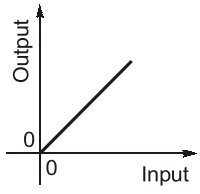
Q.3 A continuous-time system is governed by the equation:
$3y^3(t) + 2y^2(t) + y(t) = x^2(t) + x(t)$
{$y(t)$ and $x(t)$ respectively are output and input}. The system is
(a) linear and dynamic
(b) linear and non-dynamic
(c) non-linear and non-dynamic
(d) non-linear and dynamic

Q.4 Which one of the following input-output relationship is that of a linear system?

(a)


(b)


(c)


(d)


Q.5 $u(t)$ denotes the unit step function, i.e.,
$u(t) = 1$ for $t \geq 0$
$u(t) = 0$ for $t < 0$
What does the convolution of $u(t)$ with itself result in?
(a) $t^2 u(t)$ (b) $[u(t)]^2$
(c) $(t + 1) u(t)$ (d) $tu(t)$

Q.6 The impulse response $h[n]$ of a linear time-invariant system is given by
$h[n] = u[n + 3] + u[n - 2] - 2u[n - 7]$
where $u[n]$ is the unit step sequence. The above system is
(a) stable but not causal
(b) stable and causal
(c) causal but unstable
(d) unstable and not causal

Q.7 **Statement (I):** Sinusoidal signals are used as basic function in electrical systems.
Statement (II): The response of a linear system to a sinusoidal input function remains sinusoidal.
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is **NOT** the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

Q.8 (1) $y[n] = x[2\text{-}n]$ is non causal
(2) $y[n] = x[n] \cos \omega_0 n$ is causal
(3) $y[n] = \text{sgn}[x[n]]$ is non causal
Which of the above is false?
(a) 1 (b) 2
(c) 3 (d) None of these

Q.9 A system defined by

$$y[n] = \sum_{k=-\infty}^{n} x[k]$$

is an example of

Answers Linear Time Invariant Systems

1. (c)	2. (b)	3. (c)	4. (d)	5. (d)	6. (a)	7. (a)	8. (c)
9. (a)	10. (d)	11. (b)	12. (d)	13. (a)	14. (d)	15. (d)	16. (b)
17. (c)	18. (a)	19. (d)	20. (b)	21. (b)	22. (b)	23. (b)	24. (c)
25. (c)	26. (d)	27. (b)	28. (c)	29. (b)	30. (b)	31. (b)	32. (d)
33. (3)	34. (1.75)	35. (1)	36. (31)	37. (10)	38. (0.875)	39. (a,c,d)	40. (a,b)
41. (a,b)	42. (b,d)						

Explanations Linear Time Invariant Systems

1. (c)

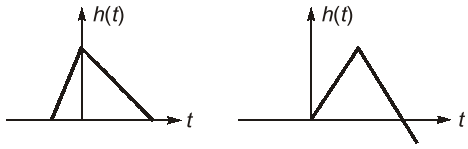
System is linear if,

1. Homogenous $\rightarrow f(kx) = kf(x)$
2. Additive $\rightarrow f(x_1 + x_2) = f(x_1) + f(x_2)$

2. (b)

For causal system : $h(t) = 0$ for $t < 0$ i.e. signal should be in RHS shifted.

Ex.



Non-causal Causal

So clearly option (b) is causal system and for causal system response depends on past and present inputs.

3. (c)

When power term present : Non linear.

When there is no arrangement of memory in system $\rightarrow$ non dynamic/static

if memory present $\rightarrow$ dynamic

So, here system is non linear, static.

4. (d)

If output follows input exactly proportionality manner, then it is linear system.

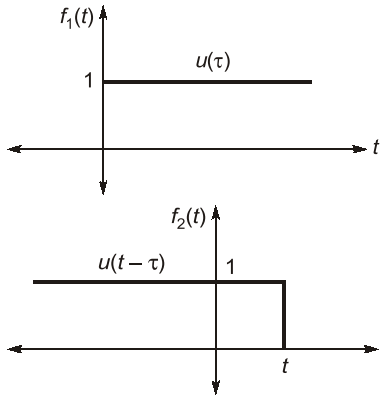
In option (a), there is an initial offset.

$\therefore$ Non-linear system.

5. (d)

$$u(t) = 1 \quad t \geq 0$$
$$= 0 \quad t < 0$$

$$f_1(t) * f_2(t) = \int_{-\infty}^{\infty} f_1(\tau)\, f_2(t-\tau)\, d\tau$$



$$\text{Convolution} = \int_{-\infty}^{\infty} u(\tau)\, u(t-\tau)\, d\tau$$

$$= \int_{0}^{t} (1) \cdot d\tau = t\, u(t) = r(t)$$

6. (a)

$h(n) = u(n+3) + u(n-2) - 2u(n-7)$