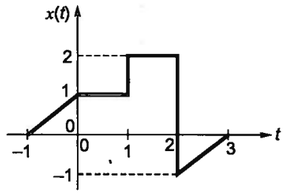
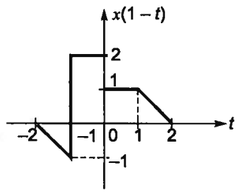
1 Introduction

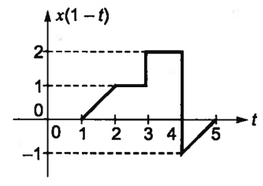
Multiple Choice Questions

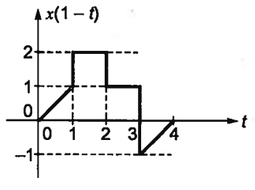
Q.1 If a plot of signal $x(t)$ is as shown in the Figure-I,

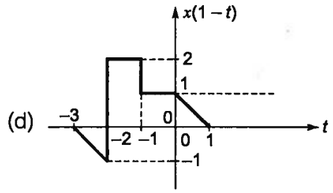


then the plot of the signal $x(1 - t)$ will be

(a)


(b)


(c)


(d)


[ESE-1991]

Q.2 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 dynamic
(d) non-linear and non-dynamic

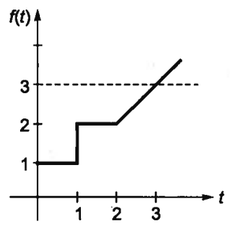
[ESE-2000]

Q.3 The signal $x(t) = A \cos(\omega t + \phi)$ is

(a) an energy signal
(b) a power signal
(c) an energy as well as a power signal
(d) neither an energy nor a power signal

[ESE-2001]

Q.4 Consider the following waveform diagram.



Which one of the following gives the correct description of the waveform shown in the above diagram?

(a) $u(t) + u(t-1)$
(b) $u(t) + (t-1)\,u(t-1)$
(c) $u(t) + u(t-1) + (t-2)\,u(t-2)$
(d) $u(t) + (t-2)\,u(t-2)$

[ESE-2004]

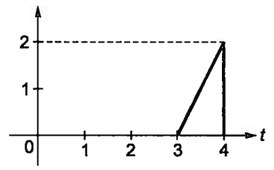
Q.5 For half-wave (odd) symmetry, with T_0 = period of $x(t)$, which one of the following is correct?

(a) $x\left(t \pm \frac{T_0}{2}\right) = -x(t)$ (b) $x\left(t \pm \frac{T_0}{2}\right) = x(t)$

(c) $x(t \pm T_0) = -x(t)$ (d) $x(t \pm T_0) = x(t)$

[ESE-2004]

Q.6 In the graph shown below, which one of the following express $v(t)$?



(a) $(2t + 6)\,[u(t-3) + 2u(t-4)]$
(b) $(-2t - 6)\,[u(t-3) + u(t-4)]$
(c) $(-2t + 6)\,[u(t-3) + u(t-4)]$
(d) $(2t - 6)\,[u(t-3) - u(t-4)]$

[ESE-2005]

Q.7 Which one of the following is the correct statement? The continuous time system described by $y(t) = x(t^2)$ is

(a) causal, linear and time-varying
(b) causal, non-linear and time-varying
(c) non-causal, non-linear and time-invariant
(d) non-causal and time-variant

[ESE-2006]

Q.8 A system with an input $x(t)$ and output $y(t)$ is described by the relation: $y(t) = t\,x(t)$. This system is

(a) linear and time-invariant
(b) linear and time varying
(c) non-linear and time-invariant
(d) non-linear and time-varying

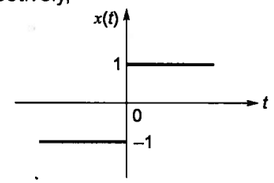
[GATE-2000]

Q.9 Convolution of $x(t + 5)$ with impulse function $\delta(t-7)$ is equal to

(a) $x(t-12)$ (b) $x(t+12)$
(c) $x(t-2)$ (d) $x(t+2)$

[GATE-2002]

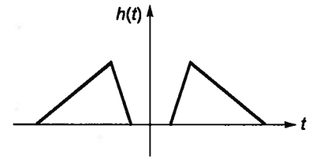
Q.10 The function $x(t)$ is shown in the figure. Even and odd parts of a unit-step function $u(t)$ are respectively,

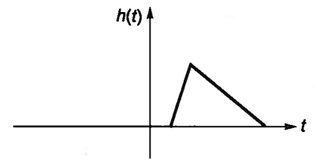


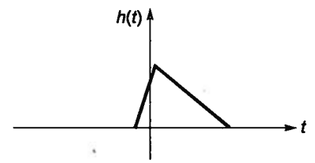
(a) $\frac{1}{2}, \frac{1}{2}x(t)$ (b) $-\frac{1}{2}, \frac{1}{2}x(t)$
(c) $\frac{1}{2}, -\frac{1}{2}x(t)$ (d) $-\frac{1}{2}, -\frac{1}{2}x(t)$

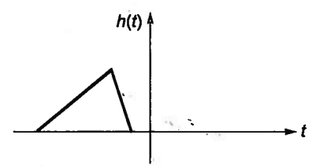
[GATE-2005]

Q.11 Which of the following can be impulse response of a causal system?

(a)


(b)


(c)


(d)


[GATE-2005]

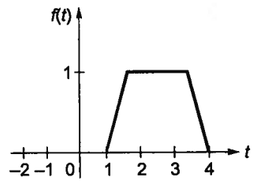
Q.12 Input causal signal $t^2 + t$ is convolved with 't' (causal) to produce output $y(t)$. If the output for similar type signal is $\frac{1}{3}y(3t)$ then the corresponding impulse response and input signal will be

(a) $3t, 3t^2 + 3t$ (b) $3t, 9t^2 + 3t$

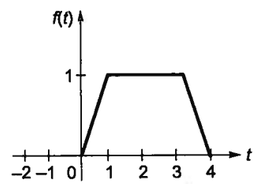
(c) $\frac{t}{3}, \frac{(9t^2+3t)}{3}$ (d) $\frac{t}{3}, t^2 + t$

Q.13 The signal $f(t) = (t-1)\,u(t-1) - (t-2)\,u(t-2) - u(t-4)$ shows the figure below

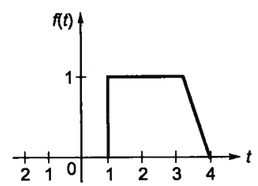
(a)



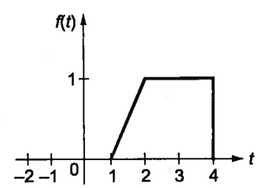
(b)



(c)



(d)



Q.14 Figure-I and Figure-II show respectively the input $x(t)$ to a linear time-invariant system and the impulse response $h(t)$ of the system.

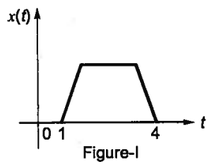


Figure-I

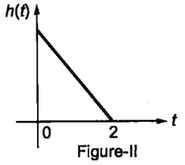


Figure-II

The output of the system is zero everywhere except for the time-interval

(a) $0 < t < 4$ (b) $0 < t < 5$

(c) $1 < t < 5$ (d) $1 < t < 6$

[ESE-1999]

Q.15 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) $f(t+t_0)\,u(t+t_0)$

[ESE-2001]

Q.16 The impulse response of a system is

$$h(t) = \delta(t-0.5)$$

If two such systems are cascaded, the impulse response of the overall system will be

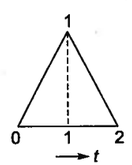
(a) $0.5\,\delta(t-0.25)$ (b) $\delta(t-0.25)$

(c) $\delta(t-1)$ (d) $0.5\,\delta(t-1)$

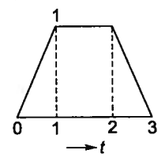
[ESE-2001]

Q.17 Let $u(t)$ be the step function. Which of the waveforms in the figure corresponds to the convolution of $u(t) - u(t-1)$ with $u(t) - u(t-2)$?

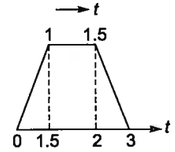
(a)



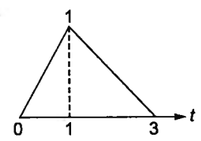
(b)



(c)



(d)



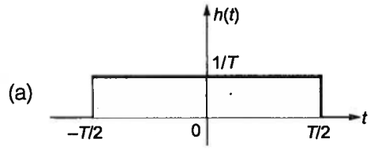
[GATE-2002]

Q.18 A continuous time LTI is described by

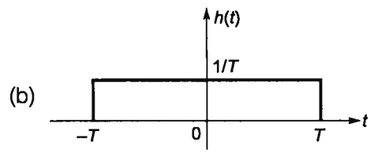
$$y(t) = T\{x(t)\} = \frac{1}{T}\int_{t-T/2}^{t+T/2} x(\tau)\,d\tau$$

The impulse response is

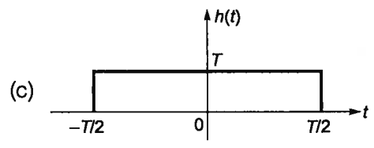
(a)



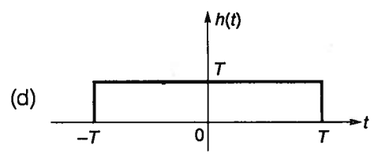
(b)



(c)



(d)



Q.19 Consider a continuous time LTI system with

$$x = \begin{cases} 1\ ;\ 0 \le t \le 1 \\ 0\ ;\ \text{else where} \end{cases}$$

and $h(t) = x(t/\alpha)$ where, $0 < \alpha \le 1$

then output $y(t) = x(t) * h(t)$; $\alpha \le t \le 1$ is given by

(a) $1/\alpha$ (b) α

(c) $2/\alpha$ (d) $2\,\alpha$

Q.20 With the following equations, the time-invariant systems are

1. $\frac{d^2y(t)}{dt^2} + 2t\frac{d}{dt}y(t) + 5y(t) = x(t)$
2. $y(t) = e^{-2\,x(t)}$
3. $y(t) = \left[\frac{d}{dt}x(t)\right]^2$
4. $y(t) = \frac{d}{dt}[e^{-2t} \times (t)]$

(a) 1 and 2 (b) 1 and 4

(c) 2 and 3 (d) 3 and 4

[ESE-2012]

Q.21 Consider two singals $x_1(t) = e^{j20t}$ and $x_2 t = e^{(-2+j)t}$.

Which one of the following statements is correct?

(a) Both $x_1(t)$ and $x_2(t)$ are periodic

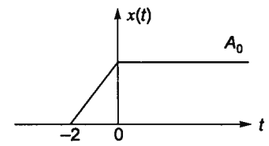
(b) $x_1(t)$ is periodic but $x_2(t)$ is not periodic

(c) $x_2(t)$ is periodic but $x_1(t)$ is not periodic

(d) Neither $x_1(t)$ nor $x_2(t)$ is periodic

[ESE-2007]

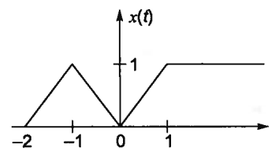
Q.22 The power of signal shown in the figure is:



(a) $\frac{A_0^2}{2}$ (b) $\frac{5A_0^2}{6}$

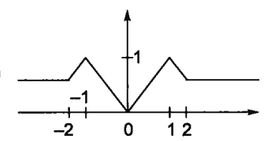
(c) $\frac{2A_0^2}{3}$ (d) 0

Q.23 A signal $x(t)$ is shown in figure below.

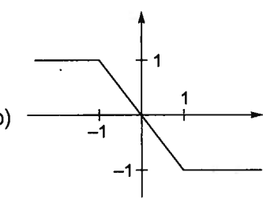


The odd part of signal $x(t)$ is

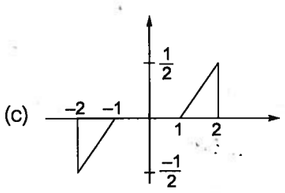
(a)



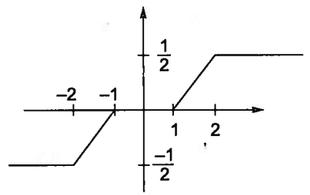
(b)



(c)



(d)

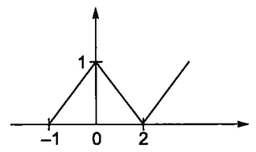


Q.24 Consider a signal $x(t)$

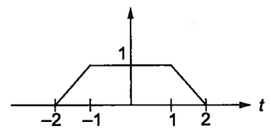
$x(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$

The correct wavefrom of $x(t)$

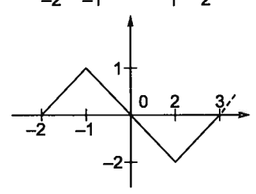
(a)



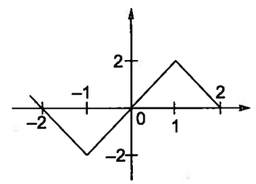
(b)



(c)



(d)



Q.25 A continuous-time system is described by $y(t) = e^{-|x(t)|}$, where $y(t)$ is the output and $x(t)$ is the input. $y(t)$ is bounded

(a) only when $x(t)$ is bounded

(b) only when $x(t)$ is non-negative

(c) only for $t \le 0$ if $x(t)$ is bounded for $t \ge 0$

(d) even when $x(t)$ is not bounded

[GATE-2006]

Q.26 A system with $x(t)$ and output $y(t)$ is defined by the input-output relation:

$$Y(t) = \int_{-\infty}^{-2t} x(t)\, d\tau$$

The system will be

(a) Casual, time-invariant and unstable

(b) causal, time-invariant and stable

(c) non-causal, time-invariant and unstable

(d) non-causal, time-variant and unstable

[GATE-2008]

Q.27 The input $x(t)$ and output $y(t)$ of a system are related as $y(t) = \int_{-\infty}^{t} x(\tau)\cos(3\tau)d\tau$. The system is

(a) time-invariant and stable

(b) stable and not time-invariant

(c) time-invariant and not stable

(d) not time-invariant and not stable

[GATE-2012]

Q.28 Which one of the following systems is a causal system?

[$y(t)$ is output and $u(t)$ is a input step function]

(a) $y(t) = \sin(u(t+3))$

(b) $y(t) = 5u(t) + 3u(t-1)$

(c) $y(t) = 5u(t) + 3u(t+1)$

(d) $y(t) = \sin(u(t-3)) + \sin(u(t+3))$

[ESE-2000]

Q.29 Which of the following system is linear?

(i). $y(t) = t\,x(t)$

(ii). $y(t) = t\,x^2(t)$

(iii). $y(t) = x(2t)$

(a) only (i) (b) (i) and (ii)

(c) only (iii) (d) None

Numerical Data Type Questions

Q.30 The power in the signal

$$s(t) = 8\cos\left(20\pi t - \frac{\pi}{2}\right) + 4\sin(15\pi t) \text{ is } \_\_\_\_.$$

[GATE-2005]

Q.31 Consider the continuous time signal $x(t) = \delta(t+2) - \delta(t-2)$. The value of E for the signal $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$ is _____.

Q.32 The Fourier series representations of a periodic current $[2 + 6\sqrt{2}\ \cos\omega t + \sqrt{48}\ \sin 2\omega t]$ A. The effective value of the current is _____ A.

[ESE-2000]

Q.33 If a signal $f(t)$ has energy E, the energy of the signal $f(2t)$ is equal to _____E.

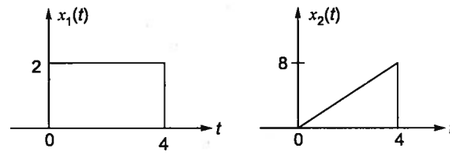
[GATE-2002]

Q.34 The period of the signal

$x(t) = 10\sin 12\pi t + 4\cos 18\pi t$ is _____.

[ESE-2012]

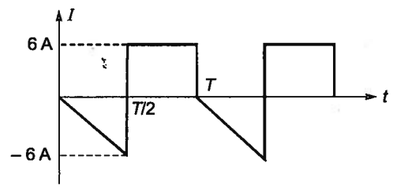
Q.35



$y(t) = x_1(t) * x_2(t)$

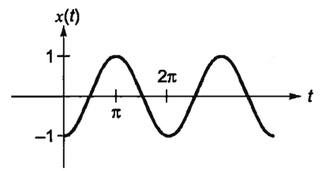
$y(2) =$ _____

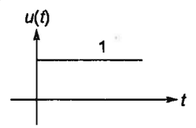
Q.36 The rms value of the periodic waveform given in figure is _____ A.



[GATE-2004]

Q.37





$y(t) = x(t) * u(t)$

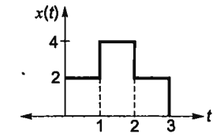
$y(\pi/2) =$ _____.

Q.38 Let g: $[0, \infty) \to [0, \infty)$ be a function defined by $g(x) = x - [x]$, where $[x]$ represents the integer part of x. (That is, it is the largest integer which is less than or equal to x). The value of the constant term in the Fourier series expansion of $g(x)$ is _____

[GATE-2014]

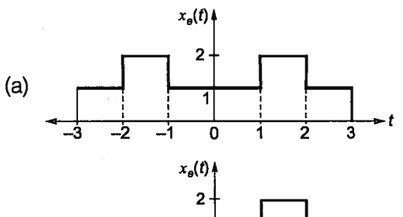
Try Yourself

T1. Let $x(t)$ be represented as shown in the figure

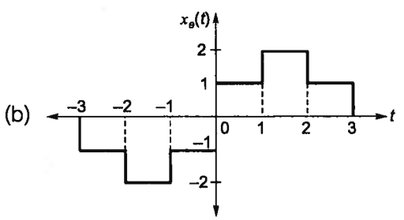


The even part of the signal can be represented as

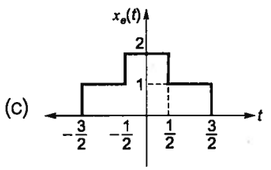
(a)



(b)



(c)

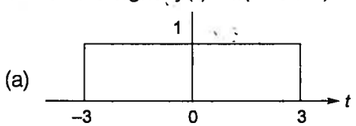


(d) None of these

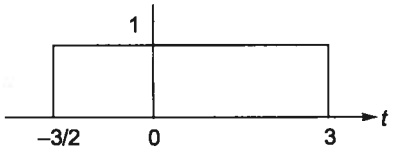
[Ans: (a)]

T2. A signal $x(t) = u(-t+5) - u(-t-4)$ is given. Sketch the signal $y(t) = x(-2t+2)$

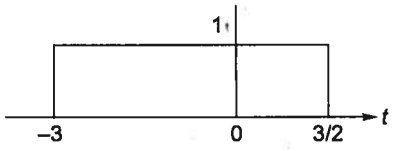
(a)



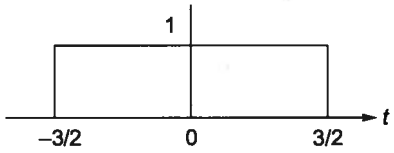
(b)



(c)



(d)



[Ans: (b)]

T3. Consider a continuous time signal $x(t)$ given by

$$x(t) = \sum_{k=-\infty}^{\infty} [\delta(t-4k) - \delta(t-1-4k)]$$

The signal is

(a) Periodic with $T_o = 4$

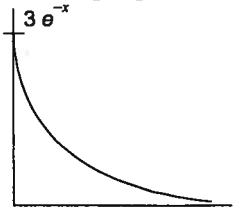
(b) Periodic with $T_o = 3$

(c) Periodic with $T_o = 5$

(d) Aperiodic

[Ans: (a)]

T4. Energy of following signal



is _____.

[Ans: (4.5)]

T5. For $x(t) = (t-1)^2$, value of $\int_{-\infty}^{\infty} x(t)\,\delta(t-1)\,dt$ _____.

[Ans: (0)]