MSMF GATE CENTRE

Subject: Signals & Systems

Introduction and LTI (LSI) System

Time: 30 min **Marks= 15**

01. The impulse response of a causal, linear, time-invariant, continuous-time system is h (t). The output y (t) of the same system to an input x (t), where x (t) = 0 for t < - 2,is

a) $\int_{0}^{t} h(\tau)\, x(t-\tau)\, d\tau$ b) $\int_{-2}^{t} h(\tau)\, x(t-\tau)\, d\tau$ c) $\int_{-2}^{t-2} h(\tau)\, x(t-\tau)\, d\tau$ d) $\int_{0}^{t+2} h(\tau)\, x(t-\tau)\, d\tau$

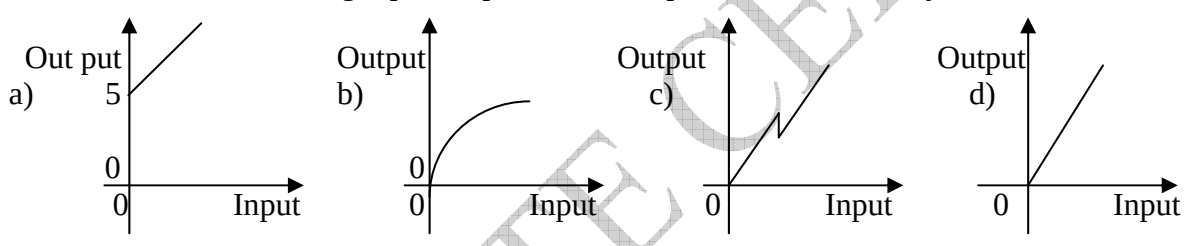
02. The impulse response of a system is h (t) = δ (t – 0.5). If two such systems are cascaded, the impulse response of the overall system will be

a) 0.5 δ (t – 0.25) b) δ (t – 0.25) c) δ (t – 1) d) 0.5 δ (t – 1)

03. The unit step response of a system is given by $(1 - e^{\alpha \tau})$ u (t). The impulse response is

a) $e^{\alpha \tau}$ u (t) b) $\alpha\, e^{\alpha \tau}$ u (t) c) $(1/\alpha)\ e^{\alpha \tau}$ u (t) d) $-\alpha\, e^{\alpha \tau}$ u (t)

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



05. 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

06. Match List – I (Characteristic of f (t)) with List – II (Functions) and the select the correct answer using the codes given below the lists **:**

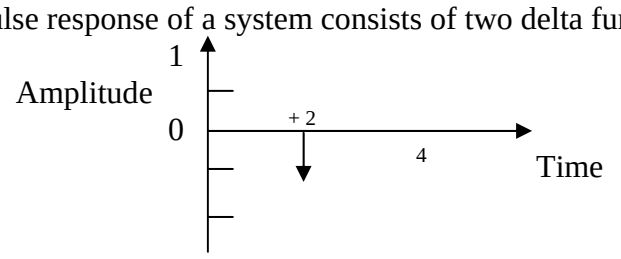
	List – I	**List – II**
A.	f(t) (1 – u (t)) = 0	1. Decaying exponential
B.	$f(t) + K \frac{df(t)}{dt} = 0$ **;** K is a positive constant	2. Growing exponential
C.	$f(t) + K \frac{d^2 f(t)}{dt^2} = 0$ **;** K is a positive constant	3. Impulse 4. Causal
D.	f (t) [(g (t) – g (o))] = 0 **;** for any arbitrary g (t)	5. Sinusoid

Codes :

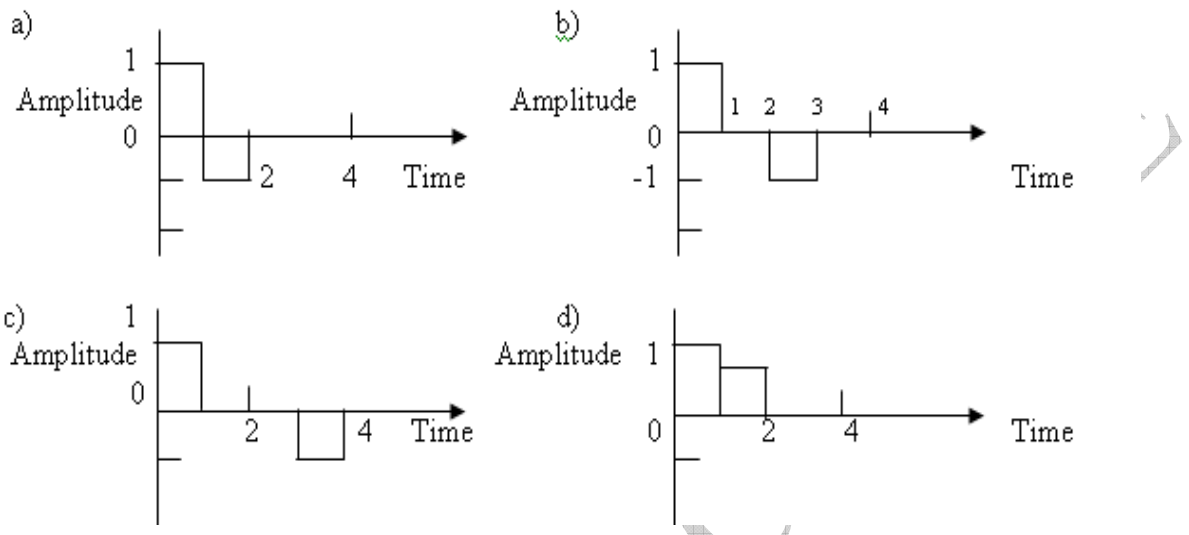
a) A B C D b) A B C D c) A B C D d) A B C D

4 1 5 3 1 4 5 3 4 2 5 1 2 5 4 1

07. The impulse response of a system consists of two delta functions as shown in the given figure.



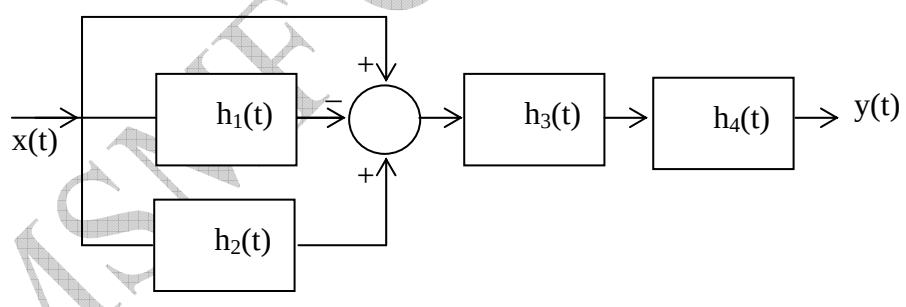
The input to the system is a unit amplitude square pulse of one unit time duration. Which one of the following diagrams depicts the correct output ?



8. 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) $\left(\frac{1}{4}\right)^n u[n-1]$

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



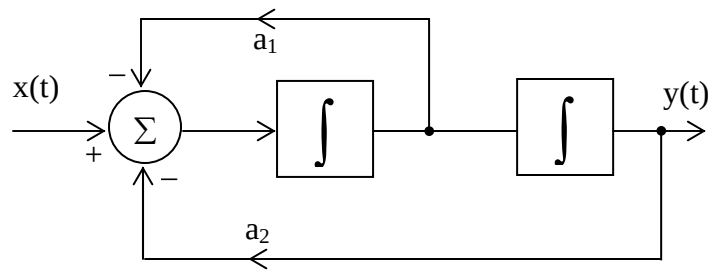
(a) $\{h_1(t) - \delta(t) + h_2(t)\} * \{h_3(t) + h_4(t)\}$

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

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

11. 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 _____

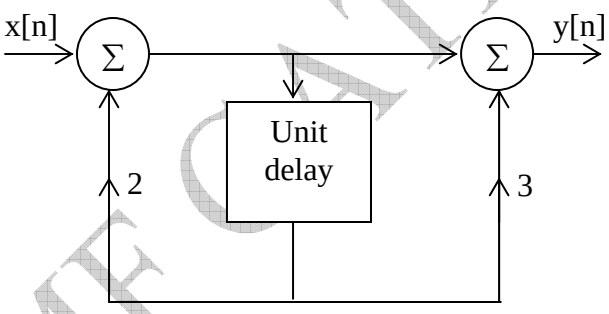
(a) $\delta[n] - (1-\alpha)\alpha^{n-1} u[n-1]$ (b) $\alpha^n u[n] - \alpha^n u[n-1]$

(c) $(1-\alpha)\alpha^n u[n]$ (d) None of these

12. 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

13. 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]

14. 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) $1-e^{-at}$

15. 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]

**** THE END ****

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SOLUTIONS

01. Ans: (d)

02. Ans: (c)

03. Ans: (d)

04. Ans: (d)

05. Ans: (b)

06. Ans: (a)

07. Ans: (b)

08. Ans: (c)

09. Ans: (c)

10. Ans: (a)

11. Ans: (a)

12. Ans: (a)

13. Ans: (d)

14. Ans: (b)

15. Ans: (c)