

**Code : 031510****B.Tech 5th Semester Examination, 2016****Signals and System***Time : 3 hours**Full Marks : 70***Instructions :**

- (i) *There are Nine Questions in this paper.*
- (ii) *Attempt Five questions in all.*
- (iii) *Question No. 1 is compulsory.*
- (iv) *All the questions carry equal marks.*

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1. Fill in the blanks of the following (any seven).  $2 \times 7 = 14$

(a) The z-transform of the sequence  $x[n]$  is given by

$$X(z) = \frac{1}{(1-2z^{-1})^2}, \text{ with the region of convergence}$$

$|z| > 2$ . Then,  $x[2]$  is..... $\delta$ .....

P.T.O.

- (b) The input output relationship of a causal stable LTI system is given as  $y[n] = \alpha y[n-1] + \beta x[n]$ . If the impulse response  $h[n]$  of this system satisfies the condition

$$\sum_{n=0}^{\infty} h[n] = 2, \text{ the relationship between } \alpha \text{ and } \beta \text{ is } \dots\dots\dots$$

- (c) Two discrete time systems with impulse responses  $h_1[n] = \delta[n-1]$  and  $h_2[n] = \delta[n-2]$  are connected in cascade. The overall Impulse response of the cascaded system is .....

- (d) For a periodic signal  $v(t) = 30 \sin 100t + 10 \cos 300t + 6 \sin(500t + \pi/4)$ , the fundamental frequency in rad/s is .....

- (e) A discrete time system has impulse response  $h(n) = 2^n u(n-2)$ , whether the system is stable or not not .....

- (f) The impulse response of a system is  $h(t) = t u(t)$ . For an input of  $u(t-1)$  the output is .....

- (g) The average power in the signal  $s(t) = 8 \cos(20\pi t - \pi/r) + 4 \sin(15\pi t)$  is .....

- (h) Fourier series is preferred for p. u. l. a. d. r. c. signal.

- (i) The lengths of two discrete time sequences  $x_1(n)$  and  $x_2(n)$  are 4 and 5, respectively. The maximum length of a sequence  $x_1(n) * x_2(n)$  is .....

- (j) For a stable LTI system, bounded input always provide bounded output.

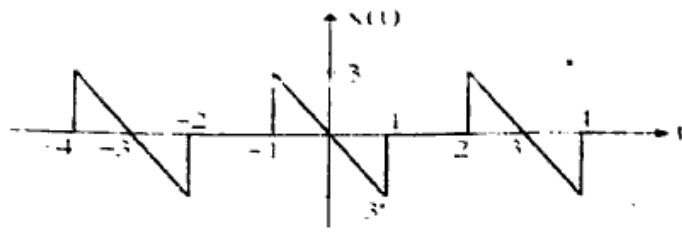
2/ Define the following :

2×7=14

- (a) Stability  
(b) Causality  
(c) Random Signal  
(d) Time variant system  
(e) Linear system  
(f) Delta function  
(g) Memory less system

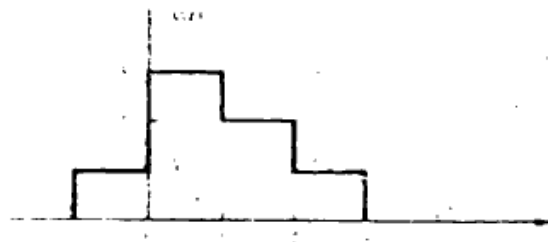
3. (a) Consider the system  $y(t) = 2 \times (t) + 3$ . Determine whether it is Memory less, Causal, Linear and Time invariant. 7

- (b) Determine the average power of signal  $x(t)$ . 7



4. A continuous time signal  $x(t)$  is shown in figure. Sketch the following signals.  $2 \times 7 = 14$

- (a)  $x(3 - t)$
- (b)  $x(4t + 1)$
- (c)  $[x(t) + x(-t)] u(t)$
- (d)  $[\delta(t + 1) + \delta(t - 1)]x(t)$
- (e)  $x(t) x(t - 5)$
- (f)  $x(t)\delta(t - 3)$
- (g)  $x(2t - 5)$



(a)  $x[n] = \sin(\pi^2 n)$

(b)  $x(t) = \cos t + \sin 3t$

(c)  $x[n] = \cos \frac{n}{4}$

(d)  $x[n] = \cos^2 \frac{\pi}{8} n$

(e)  $x(t) = \sin t + \sin 2t$

(f)  $x(n) = \sin(5\pi n)$

(g)  $x(t) = e^{-13\tau}$

8. (a) Calculate the Fourier series coefficient  $a_k$  for the continuous time periodic signal. 7

$$x(t) = \begin{cases} 1.5, & 0 \leq t < 1 \\ -1.5, & 1 \leq t < 2 \end{cases}$$

With fundamental frequency  $\omega_0 = \pi$ .

- (b) Given 7

$$X(z) = \frac{z(z-4)}{(z-1)(z-2)(z-3)}$$

- (a) State all possible regions of convergence.  
 (b) For which ROC the  $X(z)$  is z-transform of a causal sequence.

9. Write short notes on any two:

7×2=14

- (a) Properties of convolution  
 (b) Initial and Final value theorem of Laplace transform  
 (c) Energy and power signals  
 (d) Force voltage analogy

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