Printed Pages: 4 NEC - 303

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2289467 Roll No.

B.TECH.

Regular Theory Examination (Odd Sem - III), 2016-17

SIGNAL & SYSTEM

Time : 3 Hours *Max. Marks : 100*

SECTION - A

1. **Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)**

   a) Verify whether the given system described by the equation is linear and time-invariant. $x(t) = t^2$

   b) Find the fundamental period of the given signal.

   $$x(n) = \sin\left(\frac{6\pi n}{7} + 1\right)$$

   c) What is the relationship between Z transform and Fourier transform.

   d) State convolution property of Z transform.

   e) Find the fourier transform of

   $$x(t) = \sin(\omega t)\cos(\omega t).$$

f) Differentiate between CTFT & DTFT.

g) Obtain the convolution of
$x(t) = u(t)$ and $h(t) = 1$ for $-1 \le t \le 1$

h) Determine the auto-correlation function of the given signal. $x(t) = e^{(-t)} u(t)$

i) What are the necessary conditions for an LTI system to be stable?

j) Write the S domain transfer function of a first order system.

SECTION - B

Note : Attempt any five questions from this section (5×10=50)

2. a) Given x (t) = 5 cost, y(t) = 2e^{t}, find the convolution of x(t) and y(t) using Fourier transform.

b) If $X(s) = \dfrac{2s+3}{(s+1)(s+2)}$ find x(t) for

a) System is stable
b) System is causal
c) System is non causal

c) Determine the z-transform of following sequences with ROC

i) $u[n]$

ii) $-u[-n-1]$

iii) $x[n] = a^n u[n] - b^n u[-n-1]$

d) Define invertible system and state whether the following systems are invertible or not

i) y(n) = x(n)

ii) y(n) = x^2(n)+1.

e) Determine the impulse response function h(t) of an ideal BPF with passband gain of A and passband BW of B Hz centered on f_0 Hz and having a linear phase response.

f) A discrete time system is given as y(n) = y^2(n-1)+x(n). A bounded input of x(n) = 2n is applied to the system. Assume that the system is initially relaxed: Check whether the system is stable or unstable.

g) Differentiate between the following :

i) Continuous time signal and discrete time signal.

ii) Periodic and aperiodic signals

iii) Deterministic and random signals

h) Show that if $x_3(t) = ax_1(t) + bx_2(t)$ *then* $X_3(W) = aX_1(\omega) + bX_2(\omega)$

SECTION - C

Note: Attempt any two Questions from this section. (2×15=30)

3. The accumulator is excited by the sequence $x[n] = nu[n]$.

Accumulator can be defined by following input and output relationship.

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

Determine its output under the condition:

i) It is initially relaxed

ii) Initially y(-1) = 1

4. State and prove initial and final value theorem for z transform.

5. a) If Laplace transform of x(t) is $\frac{(s+2)}{(s^2+4s+5)}$ Determine Laplace transform of $y(t) = x(2t-1)u(2t-1)$

b) Use the convolution theorem to find the Laplace transform of

$$y(t) = x_1(t) * x_2(t), \text{ if } x_1(t) = e^{-3t}u(t) \text{ and } x_2(t) = u(t-2)$$