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
      \[ x(t) = \sin(\omega t)\cos(\omega t) \]

SECTION - B

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

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

   b) If \( X(s) = \frac{2s + 3}{(s+1)(s+2)} \) 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) \( x[n] = a^n u[n] - b^n u[-n-1] \)
Define invertible system and state whether the following systems are invertible or not

i) \( y(n) = x(n) \)

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

d) 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.

e) 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 \( x_3(t) = a x_1(t) + b x_2(t) \), then \( X_3(\omega) = aX_1(\omega) + bX_2(\omega) \)

**SECTION - C**

Note: Attempt any two Questions from this section.

\((2 \times 15 = 30)\)

3. The accumulator is excited by the sequence \( x[n] = nu[n] \).

4. Accumulator can be defined by following input and output relationship.

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

Determine its output under the condition:

i) It is initially relaxed

ii) Initially \( y(-1) = 1 \)

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

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

\[ y(t) = x_1(t) * x_2(t) \]

if \( x_1(t) = e^{-3t}u(t) \) and \( x_2(t) = u(t-2) \)