53 (IE 403) LSAS

2018

LINEAR SYSTEM AND SIGNAL

Paper : IE 403

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of **six**.*

1. *(a)* Determine the power and RMS value of the following signals :

$$y(t)=5\cos\left(50t+\frac{\pi}{6}\right);\ y(t)=\cos 5t.\cos 10t$$

3+3

(b) Determine the causal signal $x(n)$ having the z-transform

$$X(z)=\frac{1}{\left(1+z^{-1}\right)\left(1-z^{-1}\right)}.$$

5

(c) Check whether the following system is static or dynamic and also causal or non-causal system.

$$y(n) = x(2n);\ y(n) = 5 \cdot x(n).$$

5

(d) Find out $u(n-1) - u(n-2)$.

4

2. (a) A discrete time causal system has a transfer function

$$H(z) = \frac{\left(1 - z^{-1}\right)}{\left(1 - 2z^{-1} - 3z^{-2}\right)}$$

(i) Determine the difference equation.

(ii) Show pole-zero diagram.

(iii) Find impulse response.

4+3+3

(b) What are the conditions for a system to be LTI systems? 5

(c) Define symmetric and anti-symmetric signals. 5

3. (a) A discrete-time signal $x[n] = \{5, 2, 0, (5), -1, 3, 6, 8, 4\}$. Sketch and label each.

(i) $x(-n)$

(ii) odd part of $x(n)$

(iii) $x(n/2)$

(iv) $x(n-2) \cdot \delta(n-2)$

(v) $x(n+2) + x(n-2)$

10

(b) State the significance of impulse response. 5

(c) When a system is said to be memoryless? Give example. 5

4. (a) Compute the convolution of these pairs of signals 5+5

(i) $x(n) = \{1, (0), 2, 3, 6\}$
$h(n) = \{1, (0), 4, 3, 5, 1\}$

(ii) $x(n) = \{1, 2, 3\}, h(n) = u(n)$

(b) Verify whether the given system described by $y(t) = x(t^2)$ is linear and time invariant. 5

(c) Find the fundamental period T of the following signals, if they are periodic $x(t) = 4\cos 5\pi t$. 5

5. (a) Compute the correlation of these pairs of signal 5+5

(i) $x(n) = \{1, 2, -1\}, h(n) = x(n)$

(ii) $x(n) = \{1, (0), 2, 3, 6\}, h(n) = \{1, 4, (3), 5, 1\}$

(b) Write down the classification of systems. 5

(c) Check for periodicity of $\cos(0{\cdot}01\pi n)$. 5

6. (a) What is aliasing?

(b) Write the 4th order difference equation.

(c) Draw the following signal $u(t) = u(t-5)$.

(d) Defined Fourier transform. 5+5+5+5
