Total number of printed pages–4

53 (IE 403) LSAS

2021

LINEAR SYSTEMS AND SIGNALS

Paper : IE 403

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* Compute the correlation of these pairs of signals — 5+5=10

   (i) $x(n)=\{5, 1, 2, -1\}$, $h(n)=u(n)$

   (ii) $x(n)=\{5, \underset{\uparrow}{2}, 2, 3\}$, $h(n)=\{1, 2, \underset{\uparrow}{5}, 1\}$

   (b) Write down the classification of signals. 5

Contd.

(c) Check the periodicity of $\cos(0.02\pi n)$. 5

2. (a) A discrete-time signal $x(n)=\{2, 4, 1, (4), -1, 4, 2\}$. Sketch and label each —

(i) $2x(-n)$

(ii) even part of (x)

(iii) $x(n/3)$

(iv) $x(n+1)+x(n-2)$

(v) $x(n-1)\delta(n-1)$ 2+4+2+2+2=12

(b) State the significance of impulse response. 4

(c) When a system is said to be memoryless ? 4

3. (a) What is aliasing ? 5

(b) Write the 3rd order difference equation. 5

(c) Draw the $u(t)-u(t-3)$. 5

(d) Define Fourier transform. 5

4. *(a)* Determine the power and RMS value of the following signals : 3+3=6

$y(t)=5\cos(10t+\pi/3)$, $y(t)=\cos 2t * \cos 3t$

(b) Determine the causal signal $x(n)$ having the Z-transform — 6

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

(c) Check whether the following system is static and causal.

$y(n)=x(n+2)$. 4

(d) Find out $x(n)=u(n)-u(n+2)$. 4

5. *(a)* Compute the convolution of —

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

(ii) $x(n)=\{3, 5, 2\}, h(n)=u(n)$ 5+5=10

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

(c) Find period T of $x(z)=5\cos 2\pi t$. 5

6. *(a)* $H(z)=\dfrac{\left(1-z^{-1}\right)}{\left(1-5z^{-1}+6z^{-2}\right)}$

(i) Determine the difference equation.

(ii) Show pole-zero diagram.

(iii) Find the impulse response.

4+3+3=10

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

(c) Define linear and non-linear system. 5