53 (IE 403) LSSI

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 **seven**.*

1. *(a)* Determine the power and RMS value of the following signals 6

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

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

$$X(z) = \frac{1}{\left(1 + z^{-1}\right)\left(1 - z^{-1}\right)^2}$$ 4

(c) List the 3 properties of convolution. 5

Contd.

(d) Prove that $\delta(n) = u(n) - u(n-1)$. 5

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

$$H(z) = \frac{\left(1 - z^{-1}\right)}{\left(1 - 0{\cdot}2z^{-1} - 0{\cdot}15z^{-2}\right)}$$

(i) Determine the difference equation of the system.

(ii) Show poles and zeros diagram.

(iii) Find the impulse response. 4+3+3

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

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

3. (a) A discrete-time signal

$x[n] = \{5, 2, 0, 5, -1, 3, 6, 8, 2{\cdot}5, 4\}$

Sketch and label each.

(i) $x(-n)$

(ii) Odd part of $x(n-1)$

(iii) $x(n-2)$

(iv) $x\left(\frac{n}{2}\right)$

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

5×2=10

(b) State the significance of impulse response. 5

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

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

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

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

(b) What is the relationship between Fourier transform and Laplace transform ? 5

(c) Prove that $x(t)\cdot\delta(t-t_0)=x(t_0)\cdot\delta(t-t_0)$. 5

6. *(a)* What is Aliasing? 5

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

(c) Draw the following signals 5

(i) $u(t)-u(t-10)$

(ii) $2 \cdot n \cdot u(n-1)$

(d) Determine whether the given signal is energy signal or power signal. And calculate its energy or power $x(t)=e^{-2t} \cdot u(t)$. 5

7. *(a)* State Drichlet's conditions. 5

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

$$y(n)=x(2n)$$ 5

(c) Verify the linearity of the system

$y(t)=x\left(t^2\right) \qquad y(n)=n \cdot x(n)$

5

(d) Find the periodicity of $x(t)=4\cos 5\pi t$ and $x[n]=4\cos 0{\cdot}5n$. 5
