Total No. of printed pages = 4

19/5th Sem/UIE504

2021

DIGITAL SIGNAL PROCESSING

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 convolution of these pairs of signals 6

   x[n]={4,3,(5),1} and h[n]={5,(2),2,6}.

   (b) Check whether the following system is static or dynamic and also causal or non-causal system : $y(n) = x(n+3)$. 5

   (c) Find out $u(n) - u(n-5)$. 4

   (d) What is aliasing ? Explain. 5

2. (a) Determine the causal signal x(n) having the z-transform $H(z) = \dfrac{\left(1-z^{-1}\right)}{\left(1-5z^{-1}+6z^{-2}\right)}$. 6

[Turn over

(b) State the significance of impulse response. 4

(c) When a system is said to be memory less ? Give Example. 4

(d) Compute the convolution of these pairs of signals

$x[n] = \{3,5,2\}$, $h[n] = u[n]$ 6

3. (a) A discrete time causal system has a transfer function 10

$$H(z) = \frac{\left(1 - z^{-1}\right)}{\left(1 - 5z^{-1} + 6z^{-2}\right)}$$

(i) Determine the difference equation of the system

(ii) Show pole zero diagram

(iii) Find the impulse response.

(b) Define linear and non linear system. 5

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

4. (a) Write down the Classification of Signals. 5

(b) Check for periodicity of $\cos(.00\pi 5n)$ 5

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

(d) Find the fundamental period T of the following signals, if they are periodic.

$x(t) = 5\cos 2\pi t$ 5

5. (a) A discrete-time signal x[n]={2,4,1,(4),–1,4,2}. Sketch and label each. 10

(i) $2x(-n)$ (ii) $x(n+1)+x(n-2)$

(iii) $x\left(\frac{n}{3}\right)$ (iv) $x(n-1)\delta(n-1)$

(b) Determine the power and RMS value of the following signals : 5

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

(c) Draw the block diagram of Circular convolution using DFT. 5

6 (a) Compute the DFT of sequence x(n)=[6, i, 2, 4 + 5i]. 10

(b) What are the advantages of DSP ? 5

(c) Why are FFT techniques so important in digital signal processing ? 5

7. (a) Draw the complete signal flow graph of 4 points FFT algorithm. 5

(b) List the 3 properties of convolution integral. 5

(c) Find the inverse Z-transform of

$$X(z) = \frac{z\left(z^2 - 4z + 5\right)}{(z-3)(z-1)(z-2)}$$

for ROC (i) $2 < |z| < 3$ (ii) $|z| < 1$ 10