17661

21819

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any THREE of the following : **12**

(a) Name different parts of a digital signal processing system alongwith their functions.

(b) Write general expression for the Fourier series & state the conditions under which it can exist.

(c) State the need for sampling in an analog to digital conversion system with neat sketch.

(d) Define discrete Fourier Transform & state its three main properties.

(e) Consider analog signal $x(t) = 3 \cos 100 \pi t$ and suppose signal is sampled at the rate F_s = 200 Hz, what is discrete time signal obtained ofter sampling ?

(B) Attempt any ONE of the following : **12**

(a) State and explain the relationship between Z-Transform & Fourier transform & the conditions for their existence.

(b) Prove linearity property of Z-Transform.

2. Attempt any FOUR of the following : **16**

(a) Explain how the aliasing error occurs & its effect on the reconstructed waveform with a neat sketch.

(b) Find the minimum sampling frequency for an analog signal,

$x(t) = 5 \sin 125600\ t.$

Also, find the memory required in bits to store this signal for 30 seconds, of each sample consists of 16 bits.

(c) State & prove time-shifting property of Fourier Transform.

(d) Explain the concept of discrete Fourier Transform.

(e) Compute DFT of following sequence :

$x(n) = \{1, 0, 0, 1).$

(f) Find inverse Z-Transform of the following function using power series method :

$$x(z) = \frac{1}{1 - \sigma z^{-1}}$$

3. Attempt any FOUR of the following : **16**

(a) Draw the following signals :

(i) Continuous time signal.

(ii) Energy signal.

(iii) Deterministic signal.

(iv) Multi dimensional signal.

(b) Explain applications of Digital signal processing in video & mobile signal processing.

(c) Define a LTI system & explain its response to a complex exponential signal.

(d) Write & draw the Fourier Transform of $X(t) = e^{-u(t)}$, for $u > 0$.

(e) State any four properties of Z-Transform in mathematical terms.

4. (A) Attempt any THREE of the following : **12**

(a) State sampling theorem and its use in Digital Signal Processing.

(b) Write Fourier Transforms of the following :

(i) $z(t) = x(t) \pm y(t)$

(ii) $z(t) = x(at)$

(iii) $z(t) = \frac{dx(t)}{dt}$ &

(iv) $z(t) = e^{-at} \cdot x(t)$

(c) Explain circular convolution giving one application.

(d) Emphasize the importance of pole-zero diagram in determining system stability.

(B) Attempt any ONE of the following : **6**

(a) Analyse LTI system in frequency domain.

(b) Compare analog & digital signals on any four points.

5. Attempt any FOUR of the following : **16**

(a) Classify different signal systems, giving one characteristic of each.

(b) State & justify the sampling frequency used in audio CD player & state the sampling interval.

(c) State and prove frequency shifting property of Fourier Transform.

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(d) Determine the output sequence of a system with impulse response,

$$h(n) = \left(\frac{2}{3}\right)^n .u\left(\frac{1}{n}\right).$$

(e) Explain linear convolution with an example.

(f) State four applications of Z-Transform, describing any one in detail.

6. Attempt any FOUR of the following : **16**

(a) Differentiate between an invertible & non-invertible system with suitable examples.

(b) A square-wave has pulse-width of one milli seconds with harmonics not extending beyond the fifth.

Find :

(i) Sampling frequency

(ii) Nyquistrate

(iii) Sample interval.

(c) Compare Fourier Series with Fourior Transform, giving applications of each

(d) Find discrete Fourier Transform of $x(n) = a^n \cdot u(n)$

(e) Illustrate the procedure to draw pole-zero plot from transfer function, with suitable example.
