Tutorial No. – 03

question no. 1:– Consider an LTI system for which the input $x[n]$ and output $y[n]$ satisfy the linear constant-coefficient difference equation.

$$y[n] - \frac{1}{2}y(n-1) = x[n] + \frac{1}{3}x[n-1]$$

Use Z-transform to determine the corresponding system function $H[z]$. Also obtain related impulse response $h(n)$.

question no. 2:– Consider the signal

$$x[n] = \begin{cases} a^n & \text{for } 0 \leq n \leq N-1 \;;\; a > 0 \\ 0 & \text{otherwise} \end{cases}$$

Determine $X[z]$ and the related pole-zero pattern for $N = 16$.

question no. 3:–

If $x[n] \xleftrightarrow{Z} X[z]$ with ROC = R

then $x[n-n_0] \xleftrightarrow{Z} ?$ with ROC = ?

$x^*[n] \xleftrightarrow{Z} ?$ with ROC = ?

$$x_k[n] = \begin{cases} x(n/k) & ; \text{if } n \text{ is a multiple of } k \\ 0 & ; \text{if } n \text{ is not a multiple of } k \end{cases}$$

$x_k[n] \xleftrightarrow{Z} ?$ with ROC = ?

Here, k is an integer.

question no. 4 :-

If $x(t) \xleftrightarrow[\text{Laplace-transform}]{\mathcal{L}} X(s)$

then $x(t-t_0) \xleftrightarrow{\mathcal{L}} ?$

$e^{s_0 t} x(t) \xleftrightarrow{\mathcal{L}} ?$

$\frac{dx(t)}{dt} \xleftrightarrow{\mathcal{L}} ?$

$-t\,x(t) \xleftrightarrow{\mathcal{L}} ?$

$\int_{-\infty}^{t} x(\tau)\,d\tau \xleftrightarrow{\mathcal{L}} ?$

question no. 5 :- Obtain the discrete-time Fourier transform of $x(n)$.

$x^*(n) \xleftrightarrow{DTFT} ?$ when $x(n) \rightarrow$ Complex

$x^*(n) \xleftrightarrow{DTFT} ?$ when $x(n) \rightarrow$ real