Tutorial Sheet No. – 06

question no. 1:– The exponential signal

$$x_a(t) = \begin{cases} e^{-t} & ; \ t \geq 0 \\ 0 & ; \ t < 0 \end{cases}$$

is sampled at the rate $F_s = 20$ samples per second, and a block of 100 samples is used to estimate its spectrum. Determine the spectral characteristics of the signal $x_a(t)$ by computing the DFT of the finite-duration sequence. Compare the spectrum of the truncated discrete-time signal to the spectrum of the analog signal.

question no. 2:– Let the rectangular window be

$$W(n) = \begin{cases} 1 & ; \ n = 0, 1, \text{-----}, M-1 \\ 0 & ; \ \text{otherwise} \end{cases}$$

Obtain its DTFT as $W(e^{jw})$. Comment about its magnitude spectrum and phase spectrum.

If $\{h_d(n)\}$ is the unit sample response of an LTI system for $-\infty < n < +\infty$, and its unit sample response is modified as

$$h(n) = h_d(n) \cdot W(n)$$

then

$$H(e^{jw}) = ?$$

Whether resultant $\{h(n)\}$ is the unit sample response of an FIR or an IIR filter?

question no. 3:-

If we simply introduce a pair of complex-conjugate zeros on the unit circle at an angle w_0, then the resultant system is represented by

$$H[z] = b_0 (1 - e^{jw_0} z^{-1}) (1 - e^{-jw_0} z^{-1})$$

→ Plot its pole-zero diagram.

→ Recognize the type of filter.

→ Plot its magnitude response for $w_0 = \pi/4$.