**Duration: 3hrs** **[Max Marks:80]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

**1** Attempt any **FOUR** **[20]**

**a** Find the convolution between the sequences $x_1(n)=\{1,2,3,4\}$ and $x_2(n)=\{4,3,2,1\}$ **[5]**

**b** Determine the energy of the signal $x(n)= (1/2)^n$ , $n>=0$. **[5]**

**c** Define the properties of Time invariance, Causality, stability in continuous time domain. **[5]**

**d** Determine whether the signal $x(t) = \cos(\pi/3)\, t + \sin(\pi/4)t$ is periodic. If it is periodic, find the fundamental period . **[5]**

**e** Derive the convolution formula in discrete time domain. **[5]**

**2** **a** Determine the ZT of $a^n u(n)+b^n u(-n-1)$. Mark the ROC. **[10]**

**b** Determine the Inverse ZT of $X(z)= 1/(1-1.5z^{-1}+0.5z^{-2})$ for ROC mod(z)>1, mod(z) < 0.5, 0.5<mod(z)<1. **[10]**

**3** **a** Determine the DTFT of $x(n)=2^n u(-n)$. **[10]**

**b** Classify the System as Memory/Memoryless, Linear/Non-Linear, Causal /Non-Causal, Stable/Unstable, Time Variant/Time Invariant **[10]**
$y(t) = x^2(t)$

**4** **a** Find the convolution of $x_1(t)=e^{-3t}u(t)$ and $x_2(t)= t\, u(t)$ using Laplace Transform. **[10]**

**b** Obtain the Inverse Laplace transform if $H(s)=(2s+4)/(s^2+4s+3)$ Re(s)> -1 **[10]**

**5** **a** Find the Discrete time Fourier Series (DTFS) of the signal $x(n)=\sin(3\pi/4)n$ **[10]**

**b** Find the Discrete time Fourier Transform (DTFT) of $x(n)= u(n)-u(n-5)$ **[10]**

**6** **a** Find the Continuous time Fourier Series (CTFS) of the signal $x(t)= \sin(\pi/4)t$ and plot the spectrum. **[10]**

**b** Find the Continuous time Fourier Transform (CTFT) of the signal x(t)=1, for |t| < a otherwise x(t)=0. **[10]**

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