Duration: 3 hrs **[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 Perform the convolution of $x_1(t)=\cos t\, u(t)$ and $x_2(t)=t\, u(t)$?

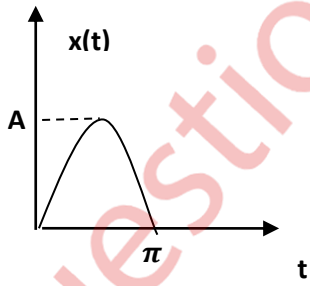
b Find the initial value and final value of Laplace transform:
$X(s) = (s+5)/(s^2(s+9))$

c Compare energy and power signals.

d What is the inverse Z transform of $X(z) = (z - 0.4) / (z^2 + z + 2)$?

e If Fourier transform of $e^{-|t|}$ is $2/(1+\Omega^2)$ then find the Fourier transform of $2/(1+t^2)$ using duality property

2 a Determine the Laplace transform of the waveform given below: [10]



b Find the response of the time invariant system with impulse response [10]
h(n)={1,2,1,-1} to an input signal x(n)={1,2,3,1}

3 a Find the inverse Laplace transform of X(s)=4/((s+2)(s+4)) if the ROC is, [10]

(i) $-2 > \mathrm{Re}\{s\} > -4$
(ii) $\mathrm{Re}\{s\} < -4$
(iii) $\mathrm{Re}\{s\} > -4$

b Determine the impulse response of the discrete LTI system (Assume initial condition as zero): [10]
$y(n) - 2y(n-1) + y(n-2) = x(n) + 3x(n-3)$

4 a Determine the Fourier transform of the expression given below: [10]

$x(t) = 1 - t^2$, for $|t| < 1$
$= 0$ for $|t| > 1$

b What is BIBO stability? What is the condition to be satisfied for stability? Explain the concept of Region of Convergence (ROC) in detail. [10]

5 a Where should the poles lie on the s-plane for stability of a causal system? Explain two properties of Fourier transform. [10]

5 b Determine the forced response of the system represented by the following equation: [10]

$5\,dy(t)/dt + 10\,y(t) = 2\,x(t)$, Input $x(t) = 2\,u(t)$

6 Write short notes on (any two) [20]

a Analogy between correlation and convolution

b Relation between continuous time Fourier Transform and Laplace Tranform

c Causality and stability of systems

d Finite impulse response systems (FIR) and infinite impulse response systems (IIR)