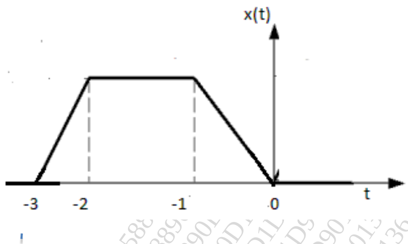
(3 Hrs) **Total Marks: 80**

NOTE : 1) Question number 1 is compulsory.
2) Attempt any three questions from the remaining five questions.
3) Assume suitable data wherever necessary.

Q.1] Answer following questions.(any four)

a) A continuous time signal is shown in Figure. Draw following version of the signal.
(i) $x(t-2)$ (ii) $x(-t+2)$ (5)



b) Perform the following convolution (5)
$x(n)= u(n)-u(n-4)$
$v(n)= (0.5)^n u(n)$

c) Determine the Laplace transform of (5)
$x(t)= \cos(\Omega o\ t)\ u(t)$

d) Find the initial value and final values of (5)

$$x(z) = \frac{2z^{-1}}{1 - 1.8z^{-1} + 0.8z^{-2}}$$

e) Find the Fourier transform of $x(n)=\{2, 1, 2\}$ (5)

Q2] a) Test whether the following system is linear and causal? (4)
(i) $y(t)= 4x(t)+\frac{dx(t)}{dt}$ (ii) $y(t)=x(-t)$

b) consider a sinusoidal signal (8)
$x(t)= 3 \cos(1000\ \pi t+0.1\ \pi)$
and let sampling frequency be Fs= 2 KHz.
(i) Determine the expression for the sampled sequence $x(n)=x(nTs)$ and determine its discrete time Fourier transform $x(\omega)=$ DTFT $[x(n)]$
(ii) Determine The Fourier Transform $X(F)= FT(x(t))$
(iii) Recompute $x(\omega)$ from $X(F)$ and verify that you obtain the same expression as in (i)

c) Determine the natural response of the first order system governed by the equation (8)
$\frac{dy(t)}{dt} + 3y(t) = x(t);\ \ y(0) = 2$

Q3] a) Determine the inverse Z Transform of (10)

$$X(z)=\frac{1}{1-0.8z^{-1}+0.12z^{-2}}$$

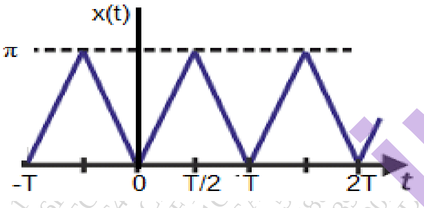
(i)If ROC is |z|>0.6 (ii) ROC is |z|<0.2 (iii) ROC is 0.2<|z|<0.6

b) Compute the DFT of the sequence
x(n) ={0, 1, 2, 3}. Sketch the magnitude and phase spectrum. (10)

Q4] a) State and prove initial and final value theorem of Laplace Transform and Z Theorem (10)

b) Determine the energy in the signal f(t)= u(t) e^{-t} (10)
(i) in the time domain
(ii) by finding energy density spectrum and integrating over frequency.

Q5] a)Find the Fourier series of the waveform shown below: (10)



b) The impulse response of the continuous time system is given by (10)
h(t)= e^{-5t} u(t). Determine the unit step response of the given system using convolution theorem of Laplace transform.

Q6] a) Explain Gibb's phenomenon (5)
b) Determine the autocorrelation function and energy spectral density of (5)
x(t)=e^{-at} u(t)
c) Determine the inverse Laplace transform of (10)

$$X(S) = \frac{1}{(s+1)(s^2+s+1)}$$
