(3 Hours) [Total Marks : 80

N.B.: (1) **Q. No. 1** is compulsory
(2) Attempt **any three** questions from remaining questions.
(3) Solve every question in a serial order.

1. Attempt **any four :**
   a) What is Sinc(x) function? Plot graphically Sinc(x) functin for the range of x : -2.5<x<2.5 — 5
   b) Obtain DTFT and plot the manitude and phase response of h(n) = {0.1,1,1} — 5
   c) Distinguish between power signals and energy signals. Is $x(t) = \cos^2(w_0 t)$ is energy signal or power signal? Find its normalized energy or power. — 5
   d) State and prove differentiation of Z-transform. — 5
   e) Check whether the following system is linear, time variant, casusal or otherwise : y(n) = x(n) + n*x(n+1) — 5

2. a) Find the response of the system — 10

$$x(t) = \frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t)$$

Subject to the initial conditions $y(0) = 2$, $y(0) = 1$ and input $x(t) = e^{-t}u(t)$.

   b) Find and sketch the Even and Odd components of the following: — 5

$x(t) = t, \quad 0 \le t \le 1$
$x(t) = 2-t, \quad 1 \le t \le 2$

   c) State and prove frequency shift property of the Fourier transform. — 5

3. a) Compute the convolution y(n) = x(n) * h(n) where X(n) = {1,1,0,1,1} and h (n) = {1,-2,-3,4} — 8
   b) Find Inverse Z-transform of the following: — 8

$$X(Z) = \frac{2Z^2 + 3Z}{Z^2 + Z + 1}; \text{ if } x(n) \text{ is causal.}$$

   c) Define ESD and PSD. What is the relation of ESD and PSD with autocorrelation? — 4

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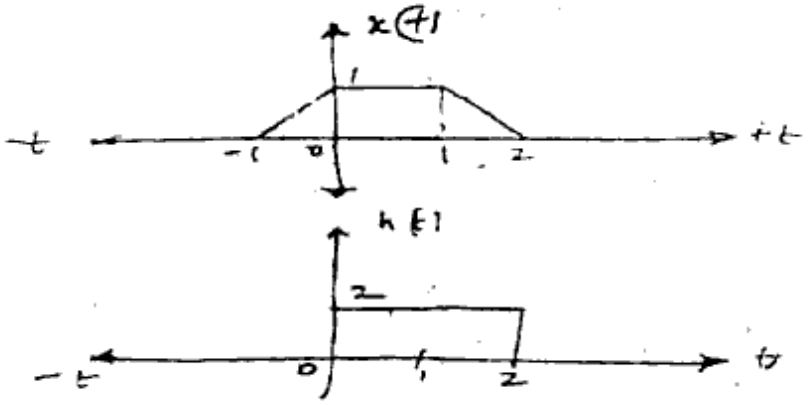
4. a) 

10

Find $y(t) = x(t) * h(t)$ of the signal shown above using graphical convolution.

b) Obtain system function H(z) for 5

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

Determine the poles and zeros and draw a pole zero plot.

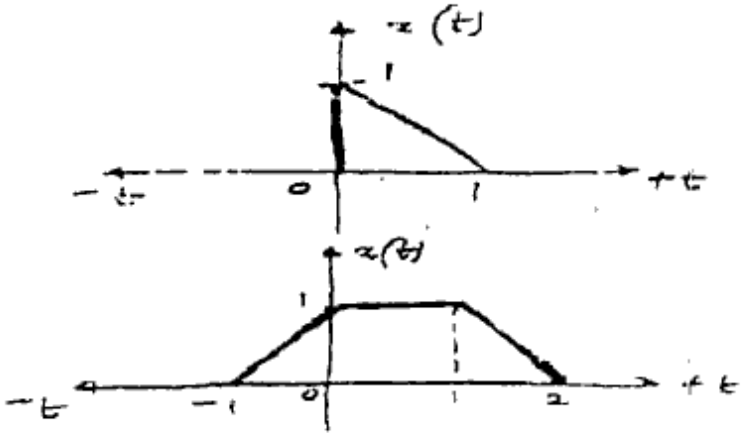
c) Obtain DTFT and plot the manitude and phase response of $h(n) = \{2,1,2\}$ 5

5. a) Determine the Z transform and sketch ROC 10

1) $x_1[n] = \left[\frac{1}{3}\right]^n ; n \geq 0$

2) $x_2[n] = x_1[n+4]$

b) 5



Obtain Laplace transform by using properties of Laplace transform only. 5

c) Determine Fourier transform of signum signal

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6. a) Obtain initial Laplace transform of $X(s) = \frac{2s^2 + 5s + 5}{(s+2)(s+1)^2}$ 10

for all possible ROC conditions.

b) Obtain Fourier transform by using properties of Fourier transform only. 10