QP Code : **5690**

(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   5
    of x : -2.5<x<2.5

    b) Obtain DTFT and plot the manitude and phase response of   5
    $h(n) = \{0.1,1,1\}$

    c) Distinguish between power signals and energy signals. Is $x(t) = \cos^2(w_0 t)$ 5
    is energy signal or power signal? Find its normalized energy or power.

    d) State and prove differentiation of Z-transform.   5

    e) Check whether the following system is linear, time variant, casusal or   5
    otherwise : $y(n) = x(n) + n*x(n+1)$

2. a) Find the response of the system   10

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

    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
    $x(t) = t, \qquad 0 \leq t \leq 1$
    $x(t) = 2\text{-}t, \qquad 1 \leq t \leq 2$

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

3. a) Compute the convolution $y(n) = x(n) * h(n)$ where   8
    $X(n) = \{1,1,0,1,1\}$ and $h(n) = \{1,-2,-3,4\}$

    b) Find Inverse Z-transform of the following: 8
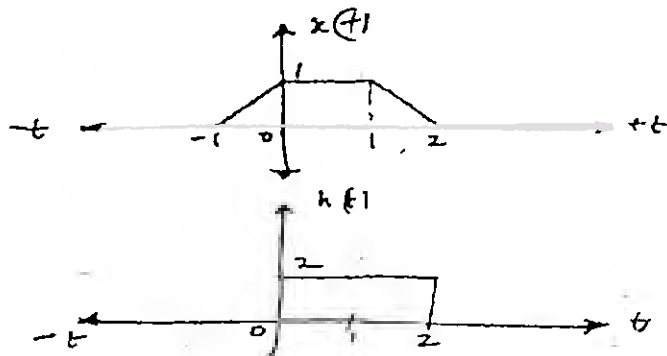
    $$X(Z) = \frac{2Z^2 + 3Z}{Z^2 + Z + 1}, \text{ if } x(n) \text{ is causal.}$$

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

[TURN OVER

MD-Con. 10165-15.

4 a)

Find y(t) = x(t)*h(t) of the signal shown above using graphical convolution.   10

   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   5
       $h(n) = \{2,1,2\}$

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

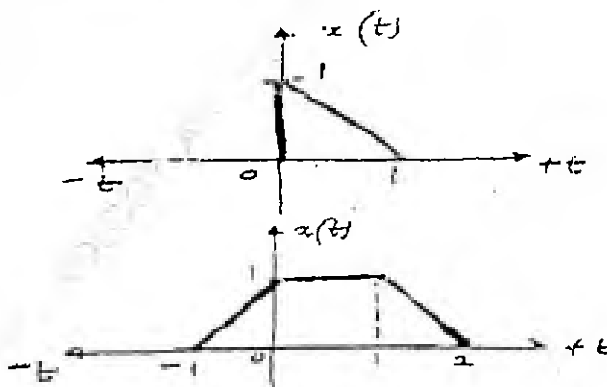   1) $x_1[n] = \left[\frac{1}{3}\right]^n ; n \geq 0$

   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

[TURN OVER

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

   for all possible ROC conditions.

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