[Time: Three Hours]   [Marks:80]

Instructions: 1. Question.No.1 is compulsory.
                  2. Attempt any three questions from remaining five questions.
                  3. Assume suitable data wherever necessary.

1   Attempt the following: 20

a.   Determine linear convolution *for* x(n)={-3, 1 ,-5 ,1, -7} & h(n)={-10 , -2 ,-3 ,-5 }

b.   Compute Laplace transform and

      $x(t) = 4e^{-3t} u(-2t) + e^{-3t}u(t - 1)$

c.   Determine the convolution using z transform for

      $x(n) = (-\frac{2}{3})^{2n} u(2n)$ *and* $h(n) = (-\frac{1}{2})^{n} u(n)$

d.   Determine Fourier series coefficients of $x(n) = \{5, 5\}$

2   a.   Prove the following properties of z–transform: 10

           1. Time-reverse property

           2. Differentiation property

           3. Correlation property

     b.   Justify whether following systems are static/dynamic, casual /non casual,   10

           stable/unstable, Time invariant/Time variant, Linear/ non Linear:

           1. $y(t) = y(t - 2) + x^2 (2t)$

           2. $y(n) = x(2n) + x(2n - 1) + x(2n - 2)$

3   a.   Justify whether following signals are energy signals or power signals.   5

           1) $x(t) = A\cos (20\pi t)$

           2) $x(n) = (-2)^{n} u(n)$

     b.   Sketch even and odd parts of the signal shown below: 5

           $x(t) = 2.5 \cos(2\pi t) + 5 \sin(4\pi t)$

     c.   Find Fourier transform sketch magnitude and phase response for signal   10

           $h(t) = e^{-2t/3}, t \geq 0$

979B3B8DC5D9603B1FF8DD6A3ADF0025

4   a.   Sketch the output signals by performing following operations on signal shown   10
         below:

$$x(t) = \delta(-t - 1) + \delta(t + 2) \qquad 1)\ x\left(\frac{3t}{2} - 1\right) \quad 2)\ x\left(\frac{t}{2}\right) \quad 3)\ x(-2 - t)$$

    b.   Determine impulse response and unit-step response of system with transfer   10
         function:

$$H(z) = \frac{2 - z^{-1} + 2z^{-2}}{1 - 3.5z^{-1} + 2z^{-2}}$$

5   a.   Determine Fourier series coefficients for the rectangular pulse signal.   5

    b.   Find impulse response h*(t)*   8

$$H(s) = \frac{s - 0.5}{(s-1)(s-2)} \ for\ all\ possible\ ROCs.$$

    c.   Find 1) Transfer function 2) Impulse Response for the system described by   7
         differential equation

$$1.5\frac{d^2y(t)}{dt^2} - 3.5\frac{dy(t)}{dt} + 2y(t) = 2.5\frac{dx(t)}{dt} - 2x(t)$$

6   a.   Determine circular convolution of signals shown below: 10

$$h_1(n) = \{1, 2, 3, 4\}, \quad h_2(n) = \{4, 3, 2, 1\}$$

    b.   State any 2 properties of Discrete-time Fourier transform (DTFT).   4

    c.   Find transfer function of the system described by the difference equation: 6

$$y(n) = -3.5y(n - 1) + 6.5y(n - 2) + 5.5x(n) - 1.25x(n - 2)$$

Also, sketch pole-zero plot

_____