[3 Hour]   **Total Marks: 80**

N:B 1) Q1 is compulsory.

2) Attempt any **three** questions from remaining questions

3) Assume suitable data wherever required.

Q1) a) Perform Circular convolution of two sequences, x[n] = {1, 3, 5, 3}

and h[n] = {2,3,1,1}.   [5*4]

b) Find the Fourier Transform of the signal, $x(t) = e^{-at} u(t)$ and plot its

Magnitude response.

c) Find the Z transform of $x(n) = na^n u(n)$

d) Check the linearity and Time variance property of the system y[n] = x [n^2]

Q2) a) Find the even and odd components of x[n] = {-1, 7,-2, 3,-7, 6}   [05]

b) Find the initial value and final value of

$$X (z) = \frac{2z^{-1}}{1-1.8z^{-1}+0.8z^{-2}}$$ [05]

c) A linear time invariant system is characterized by the system function. [10]

$$H(z) = \frac{3-4 z^{-1}}{1- 3.5z^{-1}+ 1.5z^{-2}}$$. Specify ROC of H (z) and determine h[n] for the

following conditions.

   1) The system is stable.
   2) The system is causal.
   3) The system is anti causal.

Q3) a) Prove any four properties of z-transform.   [10]

b) Obtain the magnitude and phase response of the following system by

Analytical and Geometric Method. $y(n) = x(n) - \frac{1}{2}x(n-1)$ [10]

Q4) a) Determine the response of the LTI system governed by the difference

Equation: y (n) – 0.5 y (n-1) = x (n) for input x (n) = 5^n u (n) and initial

Condition y (-1) =2.   [10]
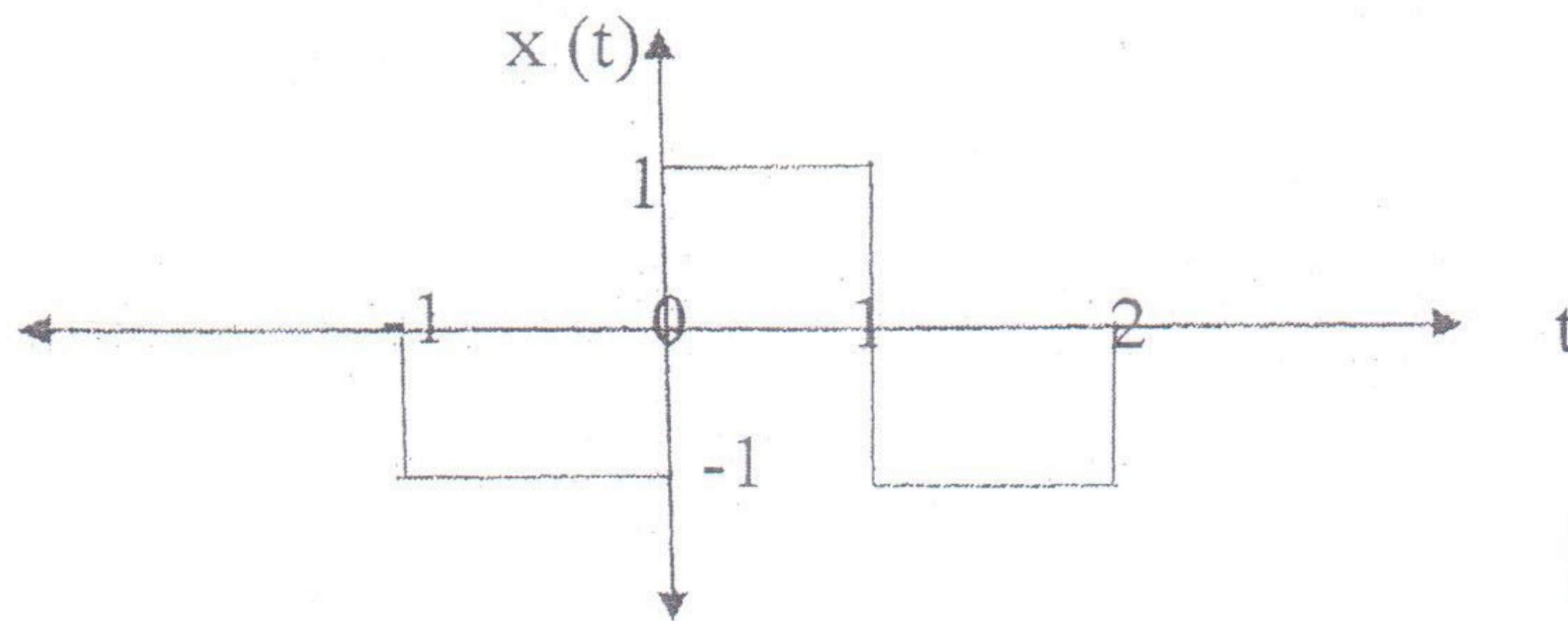
[TURN OVER

b) A continuous time signal $x(t)$ is given below. Sketch the following

Signals: a) $x_1(t) = x(-t)$ b) $x_2(t) = x(t-3)$

    c) $x_3(t) = x(t/2)$ d) $x_4(t) = x(2t-1)$ **[10]**

Q5) a) State sampling theorem. How aliasing occurs?   **[8]**

b) Perform convolution of the following Continuous Time causal signals
    $X_1(t) = 4; \ 0 \le t \le 2$ **[8]**

        $= 0;$ elsewhere

    $X_2(t) = 2; \ -2 \le t \le 2$

        $= 0;$ elsewhere

c) Evaluate the following: $\int_0^\infty 8t^2 \, \delta(3t+9) dt$ **[4]**

Q6) a) An 8 point sequence is given by $x(n) = \{2,4,6,8,2,4,6,8\}$. Compute 8 point DFT of $x(n)$ by radix - 2 DIT – FFT method.   **[10]**

    b) Prove any four DFT properties   **[10]**