Time: 3 Hours **Total Marks : 80**

N.B. 1. Question No. 1 is compulsory.
2. Attempt any three questions out of remaining five.
3. All questions carry equal marks
4. Assume Suitable data, if required and state it clearly.

1 a) Perform the convolution of $\mathbf{x_1(t)=e^{-4t}}$ u(t) and $x_2(t)=\mathbf{e^{-7t}\ u(t)}$? 20

b) Determine the even and odd parts of the signals.
x[n] = {3, -4, 1, -2} (Please note - the arrow is under -4)

c) State two properties of Laplace transform.

d) Find the inverse Fourier transform of $\mathbf{X(j\Omega) = (j\Omega +7) / (j\Omega+3)^2}$

e) Determine whether the following signals are energy or power signals:

I. $\mathbf{x(t) = cos5\Omega_0 t}$

II. $\mathbf{x[n] = sin(3\pi n/4)}$

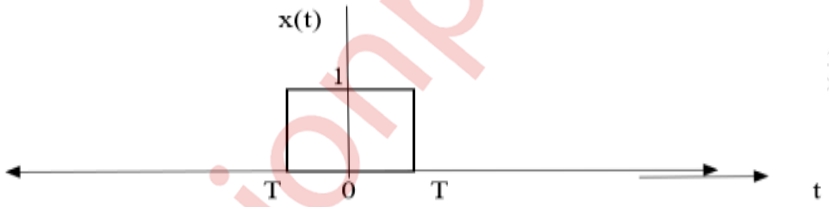
2 a) Determine the Fourier transform of the expression given below: 20

$$\mathbf{x(t) = 1 - t^2, \text{ for } |t| < 1}$$

$$\mathbf{= 0 \text{ for } |t| > 1}$$

b) Find the inverse Laplace transform of
$\boldsymbol{X(s)=(3s^2+8s+23)/((s+3)(s^2+2s+10))}$

3 a) Determine the Laplace transform of the waveform given below: 20



b) Using Z-transform, determine the response of the LTI system with impulse response $\mathbf{h[n]=0.5^n\ u[n]}$ for an input $\mathbf{x[n]=0.3^n\ u[n]}$

4 a) Find the inverse Laplace transform of $\mathbf{X(s)=4/(s+3)}$ if the ROC is, 20

(i) $\mathbf{Re\{s\} > -4}$

(ii) $\mathbf{Re\{s\} < -4}$

b) Find the initial value and final value of the following function:
$\boldsymbol{\mathcal{L}\{x(t)\}=(2s+1)/(s^2+6s+3)}$

5 a) If Fourier transform of $\mathbf{e^{-2t}\ u(t)}$ is $\mathbf{1/(1+j\Omega)}$ then find the Fourier transform of $\mathbf{1/(1+t)}$ using duality property. 20

b) Determine the response of the discrete time LTI system governed by the following differential equation, $\mathbf{3\ y[n] - 2\ y[n-1] + y[n-2] = x[n]}$ with initial conditions $\mathbf{y\ [-2] = -2}$ and $\mathbf{y\ [-1] = 1}$ for the input $\mathbf{x[n] = (1/2)^n\ u[n].}$

6 a) Determine the Z-transform and their ROC of the following discrete time signal. 20

I. $\mathbf{x[n] = 0.5^n\ u[n]}$

II. $\mathbf{x[n] = \{3,1,5,4\}}$ (Please note - the arrow is under 3)

b) Explain the following (any two):

I. Explain in brief the relation between Laplace and Fourier transform.

II. Region of Convergence

III. Convolution