(3 Hours) [Total Marks: 80]

N.B.:
1. Question No.1 is compulsory.
2. Attempt any three questions out of the remaining five.
3. Assume suitable data wherever necessary.

Q1 Answer the following 20

a) Determine discrete time Fourier series of x (n) = $\cos 2 \left(\frac{\pi}{6} n\right)$

b) Explain in brief Region of convergence (ROC) for Laplace transform.

c) Test the causality of the following system.
  1) y (t) = x(t) − x(t-1)   2) y(t) = x(t) + 3x(t+4)

d) Sketch signal e^{-6t} u(t) and determine power and energy of signal

e) State and prove linearity property of Z-transform

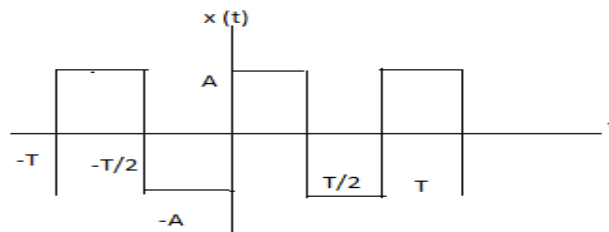Q2. a) Obtain bilateral inverse Laplace transform of the function: 10

$$X(s) = \frac{3s+7}{(s^2-2s-3)}$$

Find ROC of   Re(s) > 3

b) Determine the Fourier series of the following   signal: 10

Q3. a) Compute the convolution y (n) = x (n) * h (n) using tabulation method 10
Where x (n) = { 1, 1, 0, 1,1 }   and h (n) = { 1, -2 , -3 , 4 }

b) Determine the Fourier transform of following continuous time domain signal. 10
  i) x (t) = 1- t^2 ; for | t | < 1
       = 0   ; for | t | > 1

Q4. a) A stable system has input x (t) and output y (t). Determine transfer function and 10
Impulse response h (t) by using Laplace transform.
  x (t) = e^{-2t} u(t) ; y(t) = -2 e^{-t} u(t) + 2 e^{-3t} u (t)

b) State and prove following properties of Fourier transform. 10
  (i) Time shifting property
  (ii) Time Reversal Property

Q5. a) An LTI system is described by the equation: 10
y (n) = x(n) + 0.8 x(n-1) + 0.8 x(n-2) − 0.49 y (n-2) , determine the transfer function of
the system and also sketch the poles and zeros on the z-plane .

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b) Obtain and sketch the impulse response of the shift invariant system described by   10
y(n) = 0.4 x(n) + x(n-1) + 0.6 x(n-2) + x(n-3) + 0.4 x(n-4)

Q6. a) Using Z- transform, determine the response of the LTI system with impulse response,   10
h (n) = { 1 , -1 , 1 } , for an input x(n) = {- 2 , 3 , 1 }

b) Explain Gibbs Phenomenon   05
c) List the properties of ROC for Z- transform.   05

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