(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   a) State and prove time shifting property of Z-transform   20

b) Determine the even and odd part of the following time signals.
   i) $x(t) = 3 + 2t + 5t^2$ ii) $x(t) = e^t$

c) Explain in brief ROC (Region of Convergence) condition for Laplace transform.

d) Sketch signal $e^{-5t} u(t)$ and determine power and energy of signal.

e) For the unit step response of continuous time signal, determine the transfer function

of the system: $s(t) = u(t) + e^{-2t} u(t)$

Q2.   a) Define the following Continuous Time signals: 10

i)   Deterministic and Non Deterministic Signals

ii)   Periodic and Non periodic Signal

iii)   Causal and Non causal Signal

iv)   Even and odd Signal

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

E60CFC45F2172FDF02888C8F240D2221
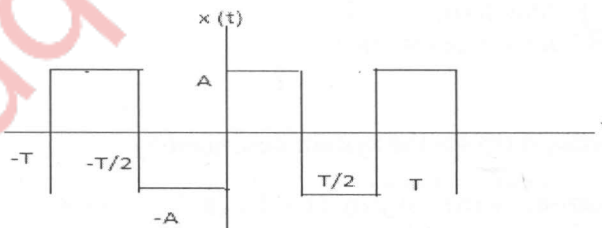
Q3. a) Define and prove the following properties of Laplace transforms: 10

     i)   Time and frequency shifting

     ii)   Amplitude Scaling and Linearity

b) Find impulse response and step response of continuous time systems governed by   10

     Following transfer functions.

$$H(s) = \frac{s+3}{s^2+6s+8}$$

Q4. a) Determine the Laplace transform of the following signals: 5
     i) $X(t) = \sin\Omega_0 t \, u(t)$
     ii) $X(t) = \cos\Omega_0 t \, u(t)$

   b)   Explain Gibbs Phenomenon in detail.   5

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

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.

   b) Determine the Z- transform and ROC of the given discrete time signal: 5
     $x(n) = 0.5^n u(n)$

   c) Why linear Convolution is important in signals and System?   5
     Differentiate linear Convolution with Circular Convolution.

Q6. 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 impulse response h (n) for the system described by   10

     Second order difference Equation, $y(n) - 4 \, y(n-1) + 4 \, y(n-2) = x(n-1)$

E60CFC45F2172FDF02888C8F240D2221