(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 h$(t)=3e^{-0.5t}$ u(t) and x(t)=1 $0 \leq t \leq 2$, otherwise x(t)=0.   20
      b) Find the Z-transform of $x[n]= a^n u[-n-1]$.
      c) Find the initial and final value of Laplace transform:
          $X(s) = 2(s^2+1)/[(s)(s+2)(s+5)]$
      d) Explain whether the system $y(t)=x(t^2)$ is a static, causal, time-invariant and linear
         system or not?
      e) Determine whether the following signals are energy or power signals:
         I. $x(t) = 3\cos 5\Omega_0 t$
         II. $x[n] = \sin(3\pi n/4)$

2   a) Obtain the Fourier transform of a periodic rectangular pulse train with a period $T_0=1$ 20
      and width $\tau = 0.1$ symmetrically placed around the origin.

      b) Determine the response of discrete time LTI system governed by the difference
      equation *y(n)-2 y(n-1)-3 y(n-2) = x(n)+ 4 x(n-1),* when the input is *x(n)= 2^n u(n)*
      and initial condition, a) *y (-2) = 0* and b) *y (-1) = 5.*

3   a) Find the inverse Laplace transform of *X(s)=(-3)/[(s+2)(s-1)]* for all possible ROCs   20
      b) Determine the Laplace transform of
      x(t)=3e^{-2t} cost(4t)-5e^{-3t} sin (2t) +2

4   a) Determine the inverse Z-transform of **X(z) = 1/ (1-0.8z-1+0.12z-2)**   20
      i.   If ROC is, **|z| > 0.6**
      ii.   If ROC is, **|z| < 0.2**
      iii.   If ROC is, **0.2 < |z| < 0.6**
      b) If Fourier transform of **e^{-t} u(t)** is **1/(1+jΩ)** then find the Fourier transform of **1/(1+t)**
      using duality property.

5   a) Determine the impulse response for the cascade of two LTI systems having impulse   20
      responses:
      h$_1$(n) = (1/2)^n u(n) and **h$_2$(n) = (1/4)^n u(n)**
      b) Using Laplace transform, determine the forced response of the system represented
      by the following equation:
          d^{2}y(t)/dt^2 + 9 dy(t)/dt + 20 y(t) = 0.2 dx(t)/dt + 2 x(t),
          Input *x(t)= 6 u(t)*

6   a)   Realize the given IIR system using direct form-I and direct form-II   20

         structure and sketch the signal flow diagram.

         H[z] = [8z^3 − 4z^2 + 11z − 2] / [(z − 0.25) (z^2 − z + 0.5)]

      b)   Explain the following (any two):
      i.   Two properties of Fourier transform.
      ii.   BIBO stability and the condition for stability.
      iii.   Explain in brief the relation between Laplace transform and Fourier transform
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