Q. P. Code: 24113

(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.

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1. Answer the following   20

    a) Determine whether the following signals are energy signals or power signals and calculate their energy or power.
        (1) $x(t) = e^{-4t}u(t)$
        (2) $x(n) = (\frac{1}{6})^{n}u(n)$

    b) Determine if following system is memoryless, causal, linear, time invariant.
        $y(t) = a^{n} x(n)$

    c) Using properties of Fourier transform, determine Fourier transform of x(t)
        $x(t) = e^{-3|t-t0|} + e^{3|t+t0|}$

    d) Find out even and odd components of following signals:
        (i) $x(n) = u(n) - u(n-5)$
        (ii) $x(t) = 5 + 7t + 9t^{2}$

    e) Determine relation between continuous time Fourier Transform and Laplace Transform.

Turn Over

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2. (a) Determine Fourier Series representation of following signal: 10
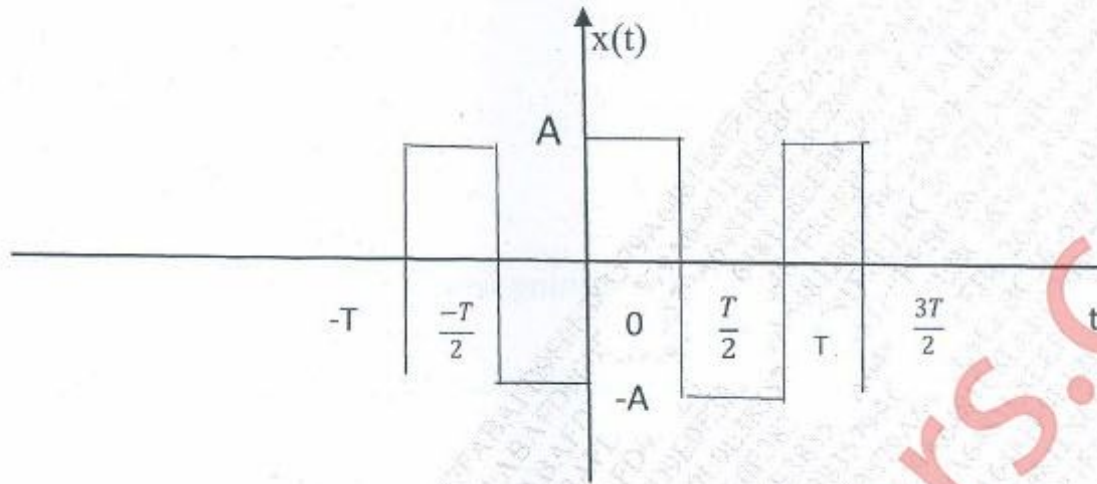
(b) Find impulse response and step response of continuous time systems governed by   10
Following transfer functions.

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

3. (a) A continuous time signal is defined as,   10

     $x(t) = t; 0 \leq t \leq 3$

     $x(t) = 0; t > 3$

     Sketch waveforms of following signals:

     (i) x(-t)   (ii) x(2-t)   (iii) x(3t)   (iv) x(0.5t+1)

(b) Determine inverse z-transform of following function using long division method: 05

$$X[z] = \frac{z^2+2z}{z^3-3z^2+4z+1}; ROC; |z| > 1$$

(c) Compute the DTFT of sequence x (n) = {0, 1, 2, 3}. Sketch magnitude and phase   05
Spectrum.

Q4] (a) Using Laplace Transform determine complete response of system described by following
   Equation.   10

$$\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = \frac{dx(t)}{dt} + x(t); \text{where } y(0) = 1; \frac{dy(0)}{dt} = 3, \text{for input } x(t) = u(t)$$

   (b) Find impulse response of system described by following difference equation   10

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + x(n-1) \text{ where all initial conditions are zero.}$$

5. (a) For the following continuous time signals, determine Fourier Transform.   10

   (i) $x(t) = e^{-at} u(-t)$
   (ii) $x(t) = \sin\omega_0(t)u(t)$

   (b) Determine Fourier series representation of $x(n) = 4\cos\frac{\pi n}{2}$ 05

   (c) Determine cross correlation of sequence $x(n) = \{1,1,2,2\}$ and $y(n) = \{1,3,1\}$ 05
                                                              ↑   ↑

6. (a) The input signal x(t) and impulse response h(t) of a continuous-time system are   10
       described as follows

       $x(t) = e^{-3t} u(t)$ and $h(t) = u(t-1)$.Find output of system using convolution integral.

   (b) Determine Z Transform and ROC of   10

   (i) $x(n) = n^2 u(n)$

   (ii) $x(n) = a^n \cos\omega_0 n \, u(n)$