Q.P. Code :11967

[Time: 3 Hours]   [Marks:80]

Please check whether you have got the right question paper.

N.B: 1. **Question No.1 is compulsory.**
        2. **Attempt any three questions out of remaining five.**
        3. Assume suitable data if required.

Q.1   Answer the following   20
a) Determine whether the following signals are energy signals or power signals and calculate their energy or power.
   (1) $x(t) = e^{-2t} u(t)$
   (2) $x[n] = (\frac{1}{2})^n u[n]$

b) Determine if following system is memoryless, casual, linear, time invariant.
   $y(t)=10 x (t) + 5$

c) Determine Fourier transform of x(t) using time shifting property
   $x(t) = e^{-3|t-t_0|} + e^{3|t+t_0|}$

d) Find out even and odd components of the following signals:
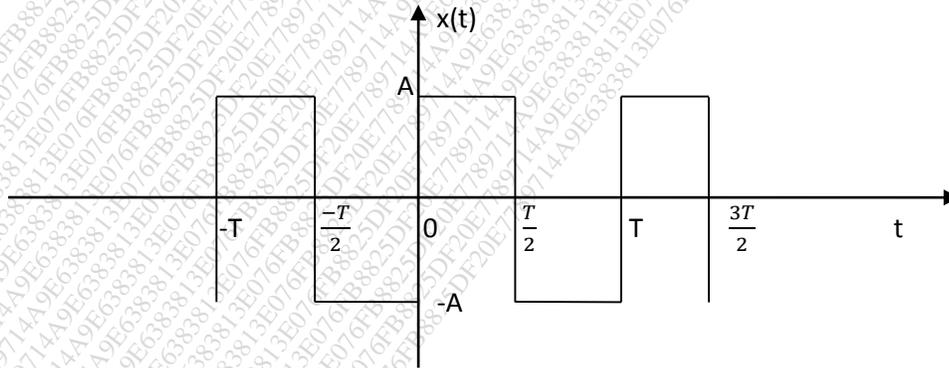   (i) $x[n] = u[n] - u[n-5]$
   (ii) $x(t) = 3+2t+5t^2$

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

Q.2 a) Determine Fourier Series representation of the following signal: 10

Q.2 b) Find impulse response of continuous time systems governed by following transfer function.   10
   (i) $H(s) = \frac{1}{s^2(s-2)}$
   (ii) $H(s) = \frac{1}{s(s+1)(s-2)}$

Q.3 a) A continuous time signals is defined as,   10
   $x(t) = t; \quad 0 \leq t \geq 3$
   $x(t) = 0; \quad t > 3$

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Sketch waveforms of following signals:
   (i)   x(-t)   (ii) x(2-t)   (iii)   x(3t)   (iv)   x(0.5t+1)

Q.3 b) Determine inverse z-transform of the following function: 05
$X[Z] = \log(1+az^{-1}); |z| > |a|$

Q.3 c) Compute DTFT of sequence $x[n] = \{0, 1, \overset{\uparrow}{2}, 3\}$. Also Sketch magnitude and phase spectrum.   05

Q.4 a) Using Laplace Transform determine complete response of system described by following equation.   10
$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4\,y(t) = \frac{dx(t)}{dt}$ where y(0) = 0; $\frac{dy(t)}{dt}\big|_{t=0}=1$, for input x(t) $e^{-2t}u(t)$

Q.4 b) Find impulse response of system described by following difference equation   10
y[n] – 3y[n-1] -4y[n-2] = x[n]+2x[n-1] where all initial conditions are zero.

Q.5 a) For the following continuous time signals, determine Fourier Transform.   10
    (i)   x(t) = $e^{-at} \sin\omega_0 t\ u(t)$

    (ii)
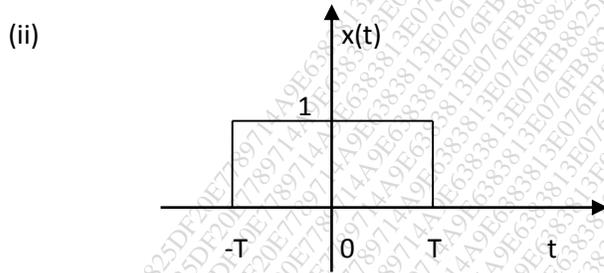
Q.5 b) Determine Fourier series representation of x[n] = $4\cos\left[\frac{\pi n}{2}\right]$ 05

Q.5 c) Determine cross correlation of sequence $x[n] = \{1, 1, \overset{\uparrow}{2}, 2\}$ and $y[n] = \{1, \overset{\uparrow}{3}, 1\}$ 05

Q.6 a) The input signal x(t) and impulse response h(t) of a continuous-time system are described as follows   10
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
      (i)   x[n] = a^n u[n-1]   05
      (ii)   x[n] = $a^n\cos\omega_0 n$ u[n]   05

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