Signals & Systems

02.16.16

QP Code : **31219**

(3 Hours) [Total Marks : 80]

N.B. : (1) Question no. **1** is **compulsory**
(2) Solve **any three** questions from question no. **2** to question no. **6**.
(3) Assume suitable data if required.

1. Solve any four questions. **20**
   (a) State the properties of Laplace transform and derive differentiation property of Laplace transform.

   (b) Prove that $\int_{-\infty}^{\infty} x(t)\,dt = 0$ if $x(t)$ is odd

   (c) Find Z -Transform of given signal and Sketch ROC
   $x(n) = 2^n u(n) + 3^n u[-n-1]$

   (d) Find the Fourier transform of two sided exponential signal.

   (e) Find the odd and even part of given signal
   $x(t) = (1+t^3)(\cos^3 10t)$

2. (a) Determine whether following Systems are static, linear, time variant, causal and stable **10**
   (i) $y(t) = x(t+10) + x^2(t)$
   (ii) $y[n] = x[n^2]$

   (b) If $x_1[n]$ and $x_2[n]$ are two periodic sequences given below. Find the convolution **10**
   between them
   $x_1[n] = [1, -2, 0, 1]$ and $x_2[n] = [2, 1, 1, 0]$
   $\uparrow$ $\uparrow$

3. (a) Find inverse Laplace transform for all possible Rocs. **10**

   $$x(s) = \frac{5s-10}{9s^2-16}$$
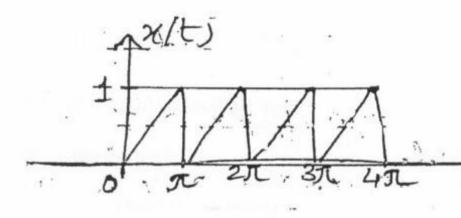
   (b) Find out z^{-1} of the following signal. **10**

   $$x(z) = \frac{16z^2 - 4z + 1}{8z^2 + 2z - 1} \quad \begin{array}{c} \text{R.O.C.is} \\ |z| > \frac{1}{2} \end{array}$$

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4. (a) Find trigonometric Fourier series of given x(t) signal   10

   (b) $H(s) = \dfrac{1}{(s^2 - 16)(s^2 - 9)}$ 10

       Determine h(t) if
         (i)   System is stable
         (ii)   System is causal
         (iii)   System is neither stable nor causal

5. (a)   Sketch the following Signal   10
        $x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3)$
            $+u(t-4) - 2u(t-5)$

   (b) Find Laplace transform of following and draw R.O.C   10
        (i) $x(t) = \sin(\omega t)\, u(t)$
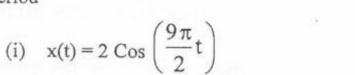   (ii) $x(t) = t\, u(t) * e^{-3t}\, u(t)$

6. (a) Find whether given signals are energy or power signals   6
        (i) $x(n) = n \quad n \geq 0$
                 $= 0 \quad n < 0$
        (ii) $x(t) = A e^{-5t} u(t)$

   (b) State the Diricehlet conditions for the existence of Fourier series.   4

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(c) Determine whether following signals are periodic or not. It Periodic find Fundamental period 4

    (i) $x(t) = 2 \, Cos \left(\dfrac{9\pi}{2} t \right)$

    (ii) $x(n) = Cos \, (0.01 \, \pi \, n)$

(d) Carry out the following operations on the signal shown in figure below. 6
    (i)   x (1-t)
    (ii)   [x(t) +x(1-t)] u (t-1)