T. E. (ETRX) Sem I (R)   21/12/09

(LG)

Continuous Time Signals & System

(3 Hours)   [Total Marks : 100

2-3 do 5-30

N.B. (1) Question No.1 is **compulsory**.
      (2) Attempt any **four** questions out of remaining **six** questions.
      (3) **Figures** to the **right** indicate marks.

1. Solve any **four** of the following :—   **20**

     (a) Define unit step and unit impulse function. State their relationship with its significance.

     (b) Find the even and odd components of the following signal :—
        $x(t) = \cos t + \sin t + \cos t \sin t$

     (c) Find whether the following system with impulse response is stable or not :—
        $h(t) = e^{-t} \cos 2t \, u(t)$

     (d) State and explain the important properties of continuous time fourier series.

     (e) Obtain the forced response of the system with T/F for unit step input :—

$$H(s) = \frac{1}{\left(s + \dfrac{1}{2}\right)(s + 1)}$$

2. (a) Plot the following signal :—   **10**
       (i) $x_1(t) = r(t) - 2u(t - 1) - r(t - 2)$
       (ii) $x_2(t) = 3u(t) + t\,u(t) - [t - 1]u(t - 1) - 5u(t - 2)$

   (b) Find the convolution of x (t) and h (t) by using graphical method :—   **10**
     $x(t) = 1, \quad 0 \le t \le 2$
         $= 0, \quad \text{otherwise}$
     $h(t) = 1, \quad 0 \le t \le 3$
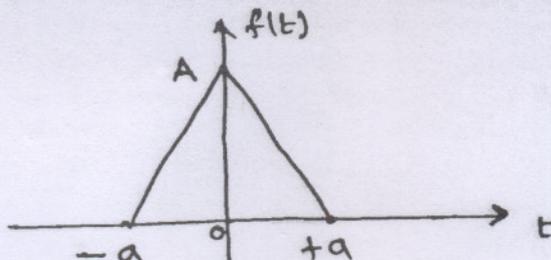 $= 0, \quad \text{otherwise}$

3. (a) Draw the amplitude and phase spectrum of full wave rectified time domain signal.   **10**
   (b) Find fourier transform of triangular pulse f (t) shown below·:—   **10**

4. (a) What are random functions ? Explain moments of random functions with suitable examples.   **10**

   (b) The T/F of CT – LT₁ system is $H(s) = \dfrac{(s + 3)}{(s + 4)(s + 5)}$. find the systems response to   **10**

the input $x(t) = e^{-t}u(t)$, if initial conditions are $Y(0-) = 1, Y'(0-) = \dfrac{13}{2}$.

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5. (a) State initial value and final value theorem. Find initial value and final values, if they   **10**
exists of the signals with Laplace transform given below :—

$$X(s) = \frac{s^2 + 5s + 7}{s^2 + 3s + 2}$$
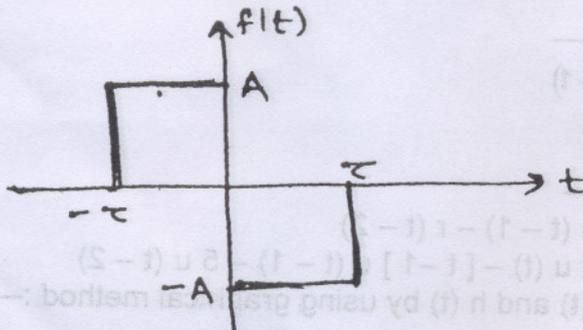
    (b) Obtain state space equations for given T/F of a system :—   **10**

$$H(s) = \frac{s^2 + 3s + 4}{s^2 + 7s + 13}$$

6. (a) Obtain state transition matrix for the given T/F of a system :—   **10**

$$H(s) = \frac{5s + 4}{s^2 + 3s + 2}$$

    (b) Find FT of time domain non periodic signal f (t) as shown below :—   **10**

7. Write short notes on the following :—   **20**
    (a) Parseval's Theorem
    (b) BIBO Stability and ROC
    (c) Modulation Property
    (d) Random Processes.