14/12/11 TE ETRX Sem-V (Rev) Continuous Time Signals & System

Con. 6547-11. (REVISED COURSE) MP–3828

(3 Hours) [Total Marks : 100

N.B. **(1) Question No.1 is compulsory,**

(2) Attempt any four questions out of remaining six questions.

(3) Assume suitable data wherever required but justify the same.

1. Solve any four:- [20]
   (a) State the conditions which are required to be satisfied by function *f(t)* for Fourier series to exist.
   (b) Define ESD and PSD. What is the relation of ESD and PSD with autocorrelation?
   (c) Calculate average power of the given signal

   $$x(t) = 3Cos(5w_0t)$$

   (d) What is the PDF of Uniform, Exponential and Gaussian distribution?

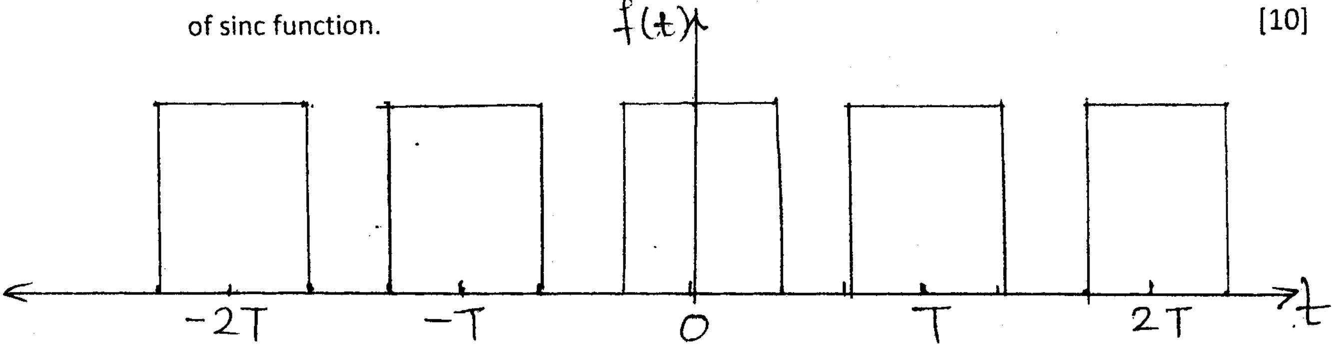
   (e) Classify the following system on the basis of stability and causality,

   $$y''(t) - 2t.y'(t) = x(t)$$

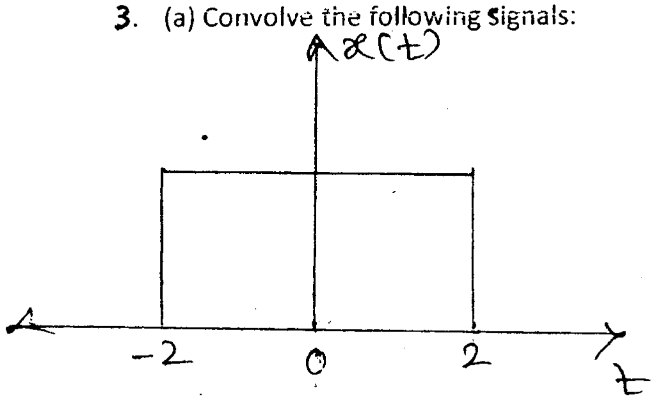
2. (a) Derive the relation between Fourier Transform and Laplace Transform. Find the inverse Laplace Transform of the following signal, [10]

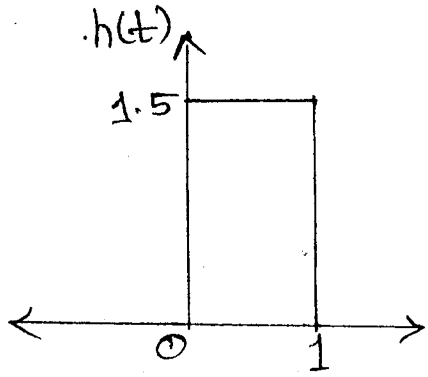
   $$X(S) = 2s + 4 / s^2+4s+3 \quad \text{for all possible ROCs.}$$

   (b) For the following signal, Show that the Fourier transform of periodic Gate function is a form of sinc function. [10]



3. (a) Convolve the following Signals: [10]





   (b) Sketch x(t) if [10]

   $$x(t) = 2u(t) + u(t-2) - u(t-4) + r(t-6) - r(t-8)$$

   Hence obtain $x(2t+2)$

[TURN OVER

4. (a) The differential equation of the system is given as follows:

$$y''(t) = 4y'(t) - y(t) + 4x'(t) + 2\,x(t)$$ [10]

Determine impulse response and state variable model of the system.

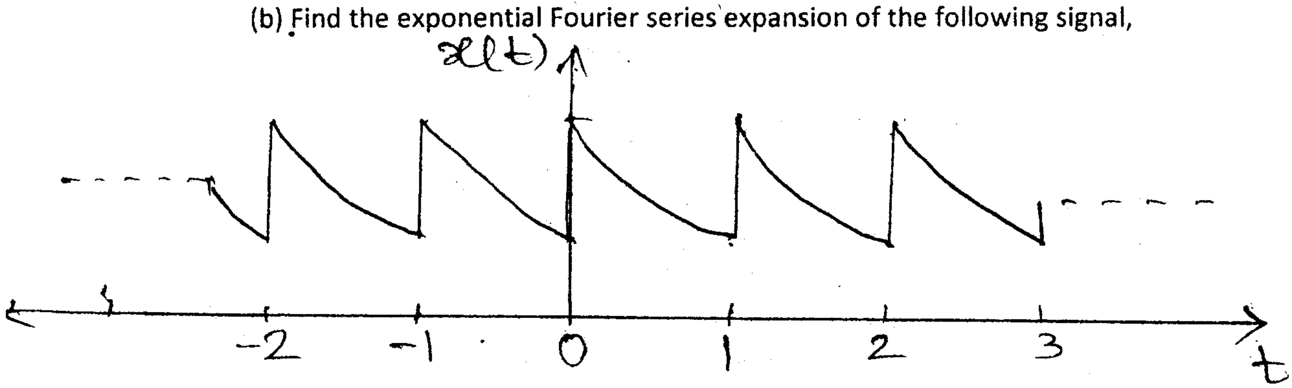
(b) State initial and Final value theorem of Laplace transform. Also find initial and final value

$$x(s) = \frac{2(s2+1)}{s(s+2)(s+5)}$$ [10]

5. (a) Find the autocorrelation , PSD, and power of the following signal; [10]

$$X(t) = 6\mathrm{Sin}2t$$

(b) Find the exponential Fourier series expansion of the following signal, [10]



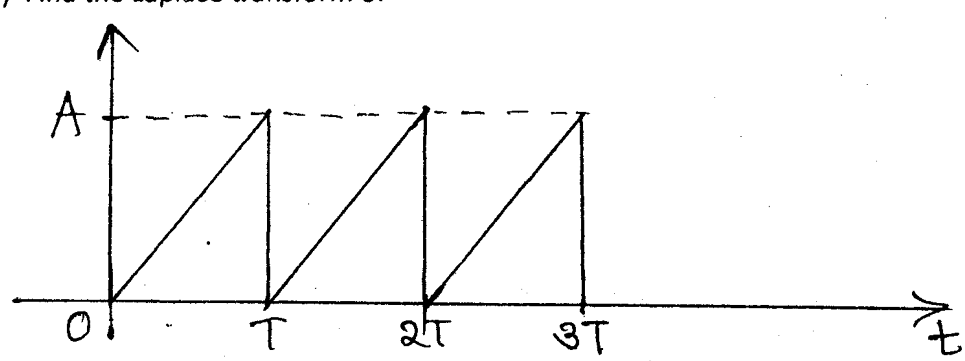
6. (a) State variable model of the system is given as follows, [12]

$$\begin{bmatrix} x1^{\bullet}(t) \\ x2^{\bullet}(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x1(t) \\ x2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \cdot r(t)$$

$$\begin{bmatrix} y1(t) \\ y2\,(t) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x1(t) \\ x2(t) \end{bmatrix} \quad \text{and} \quad x(0)^T = \begin{bmatrix} 1 & 1 \end{bmatrix}$$

Determine response of the system to unit step input.

(b) Find the Laplace transform of [8]



7. Write short notes on the following: [20]
   (a) Rayleigh's energy theorem
   (b) State transition matrix
   (c) Energy signals Vs Power signals
   (d) Random processes

****