T.E. Sem 5 (Rev.) Etrx. Continuous Time Signals & Systems 27/12/08.

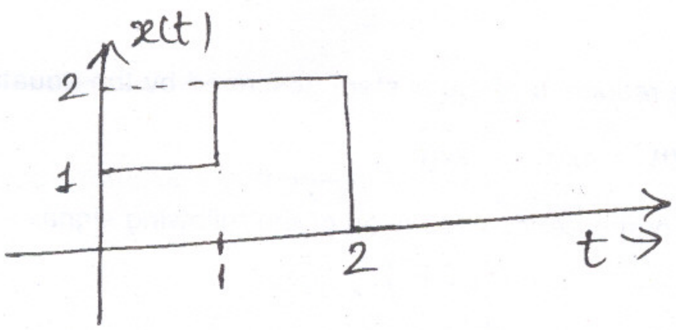
Con. 5626-08. **RC-6470**

(REVISED COURSE)

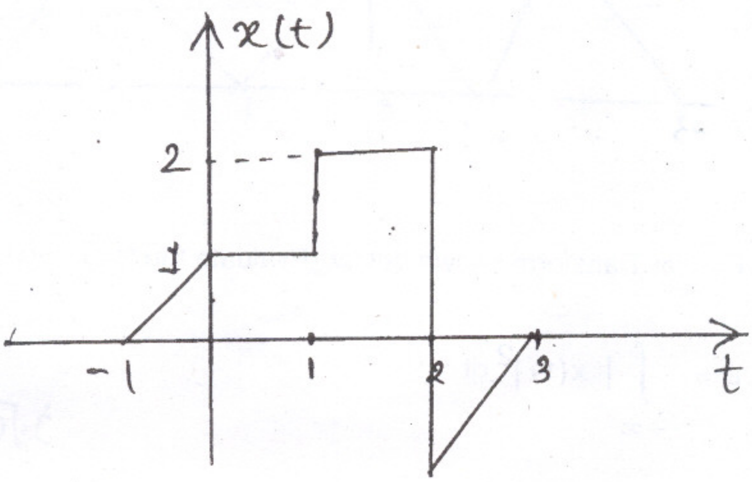
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **four** out of remaining **six** questions.
(3) Assume **suitable** data if **necessary**.
(4) **Figures** to the **right** indicate **marks**.

1. Attempt any **four** of the following :— 20
   (a) Find whether following signals are Energy or Power. Find corresponding Energy/ Power if.
      (i) $x(t) = A \cdot e^{-at} \ u(t), \ a > 0$
      (ii) $x(t) = \text{rect}\left(\frac{t}{T_0}\right)$.
   (b) Determine whether following signals are periodic or non periodic
      (i) $x[n] = 5 \cos [0 \cdot 2 \pi n]$
      (ii) $x(t) = \sin(2t) + \sin(2\pi t)$
   (c) Classify the following system on the basis of Linearity, Causality and Time Variance.
   $$\frac{d}{dt} y(t) + 10y(t) = x(t).$$
   (d) Express x(t) as shown in **figure** using unit step signal



   (e) For the signal x(t) shown below **sketch**
   $y(t) = x(t) \cdot [\ \delta(t + 3/2) - \delta(t - 3/2)\ ]$

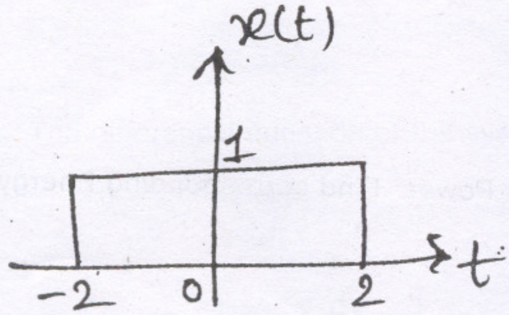


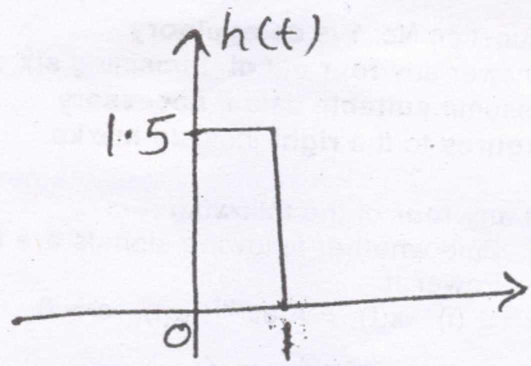
2. (a) Sketch x(t) if 10

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

Hence obtain $x(2t+2)$

(b) Convolve the following signals— 10





3. (a) A continuous time LTI system is described by following differential equation— 10

$$2\frac{d^3}{dt^3}y(t) + 3\frac{d^2}{dt^2}y(t) + 4\frac{dy}{dt}y(t) + 6y(t) = 2x(t)$$

Obtain the State Model for the given system.

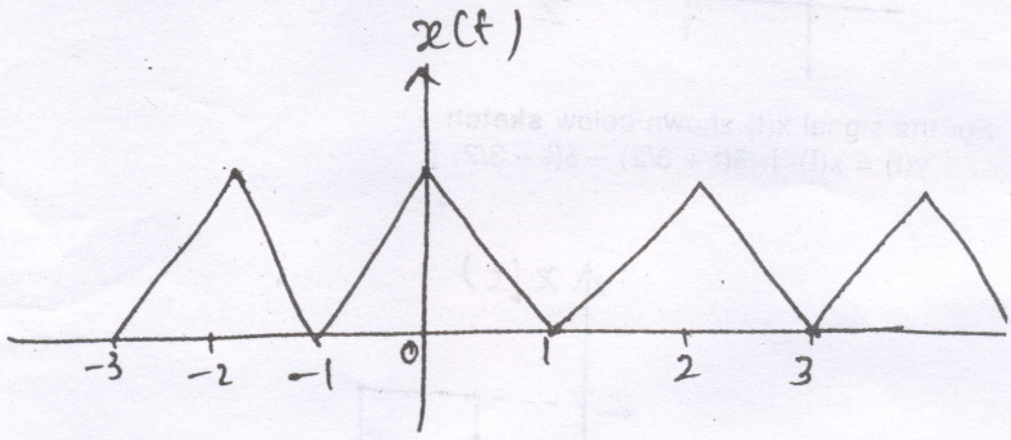
(b) Find the state transition matrix e^{At} for the following model—

$$A = \begin{bmatrix} \frac{3}{4} & 0 \\ \frac{-1}{2} & \frac{1}{2} \end{bmatrix}$$

(c) Determine the impulse response of the system described by the equation 4

$$\ddot{y}(t) = 4\dot{y}(t) - y(t) + 4\dot{x}(t) + 2x(t)$$

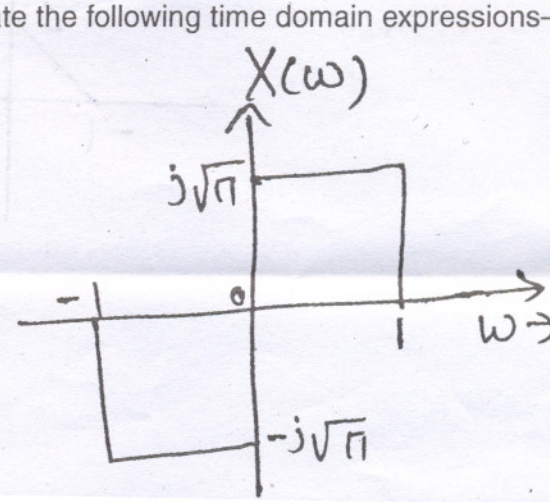
4. (a) Find the exponential Fourier series expansion of the following signal— 8



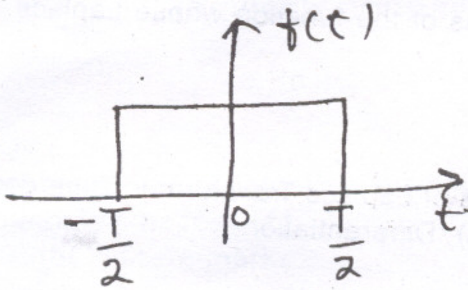
(b) From the Fourier Transform shown below. Evaluate the following time domain expressions— 12

(i) $E = \int_{-\infty}^{\infty} |x(t)|^2 dt$

(ii) $D = \frac{d}{dt}x(t)$



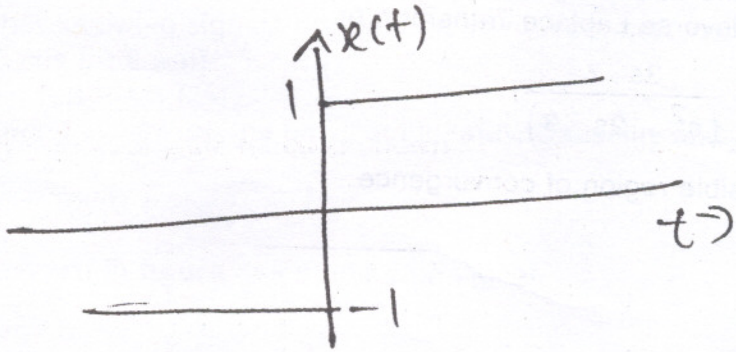
5. (a) Find the Fourier transform of Gate function shown : 6



(b) Find the Fourier transform of following function f(t). 10

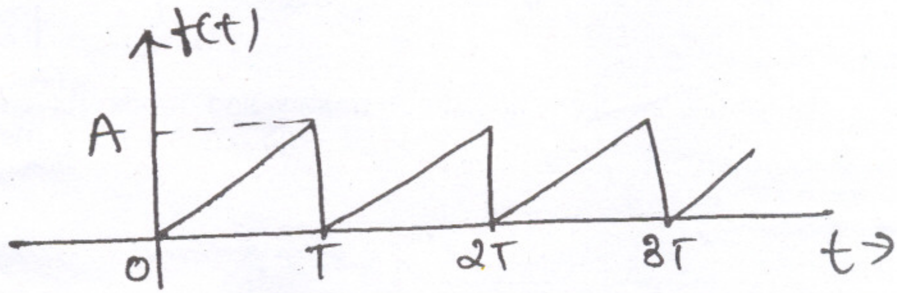
$$f(t) = \begin{cases} e^{-at} & \text{for } t \geq 0 \\ -e^{at} & \text{for } t \leq 0 \end{cases}$$

Using the result of above obtain Fourier Transform of x(t) as shown below :



(c) State and prove convolution property of Fourier Transform in Time domain. 4

6. (a) Find Laplace Transform of the signal shown below : 8



(b) Determine the initial and final values of the function whose Laplace Transform is given by— 4

$$X(s) = \frac{5s+50}{s(s+5)}$$

(c) State and prove following properties of Laplace Transform in Time domain : 8

(i) Time Scaling (ii) Differentiation

7. (a) The differential equation of the system is given as 10

$$\frac{d^2y(t)}{dt^2} + \frac{3dy(t)}{dt} + 2y(t) = x(t)$$

with $y(0^+) = 3$ and $\left.\frac{dy}{dt}(t)\right|_{t=0} = -5$

Determine the output for $x(t) = 2u(t)$

(b) Obtain the inverse Laplace Transform of : 10

$$X(s) = \frac{3s+7}{\left(s^2-2s-3\right)}$$

For all possible region of convergence.