S.No. : 390

BEC 2403

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Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 23408 Roll No.

B. Tech. Examination 2021-22

(Even Semester)

SIGNALS AND SYSTEMS

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION – A

1. Attempt all parts of the following : 8×1=8

   (a) Define periodic and aperiodic signals.

   (b) Define a system. How the systems are classified?

   (c) Sketch u (n) – u (n – 1).

   (d) Write the mathematical expression for the signal shown in figure :

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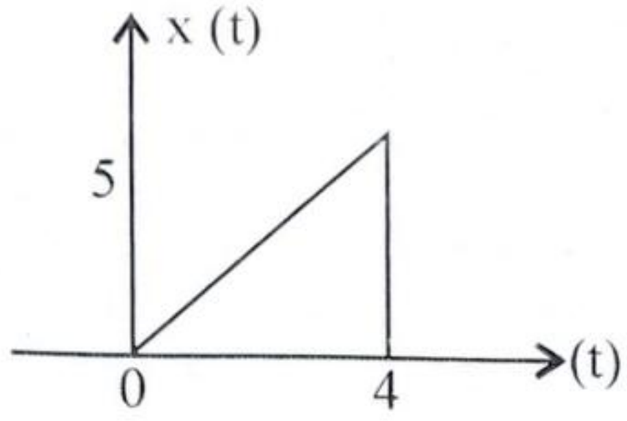


(e) Define Fourier transform of a signal x (t).

(f) What is the condition for existence of Fourier transform of a signal x (t).

(g) Consider an LTI system with impulse response $h(n) = \delta(n - n_0)$ for an input x (n), find $Y(e^{jw})$.

(h) Distinguish between energy spectral density and power spectral density.

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

(a) Find whether the following signals are periodic or not :

(i) $x(t) = 2\cos(10t + 1) - \sin(4t - 1)$

(ii) $x(t) = \cos 60\pi t + \sin 50\pi t$

(iii) $x(t) = 4(t) - \frac{1}{2}$

(b) Check whether or not the given systems are lienar, time invariant, causal, memory less and stable :

(i) $y(t) = x(t-2) + x(2-t)$

(ii) $y(t) = \frac{dx(t)}{dt}$

(c) Find the step response of the following systems whose impulse responses are given by :

(i) $t\,u(t)$

(ii) $\delta(t) - \delta(t-1)$

(iii) $e^{-3t}\,u(t) - e^{-2t}\,u(t)$

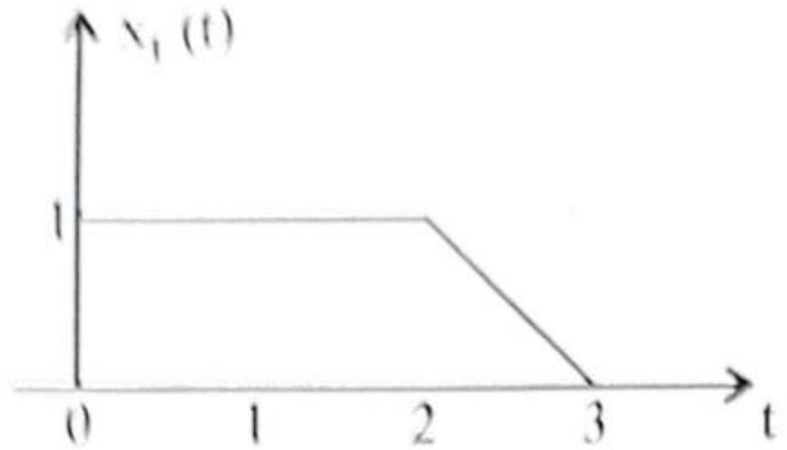
(d) Find the auto correlation of the signal :

$x(t) = A \sin(\Omega_{ot} + \theta)$ where $\Omega_o = \frac{2\pi}{T}$

SECTION – C

Note :– Attempt all questions. Attempt any two parts from each questions. 5×8=40

3. (a) Consider the signal $x_1(t)$ shown in figure plot $x_1(t-1) + x_1(-t+2)$:



(b) Determine the energy and power of the following signals :

(i) $x(t) = t\,u(t)$

(ii) $x(n) = 2\,e^{j3\pi n}$

(c) Check whether the following systems are static or dynamic :

(i) $y(n) = x(n+1) - x(n-1)$

(ii) $y(t) = 10\,x(t) + 5$

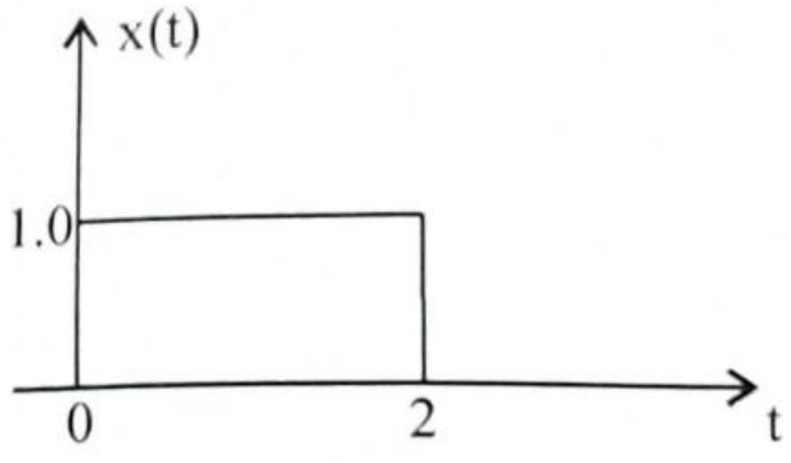
4. (a) Find the convolution of the following signals :

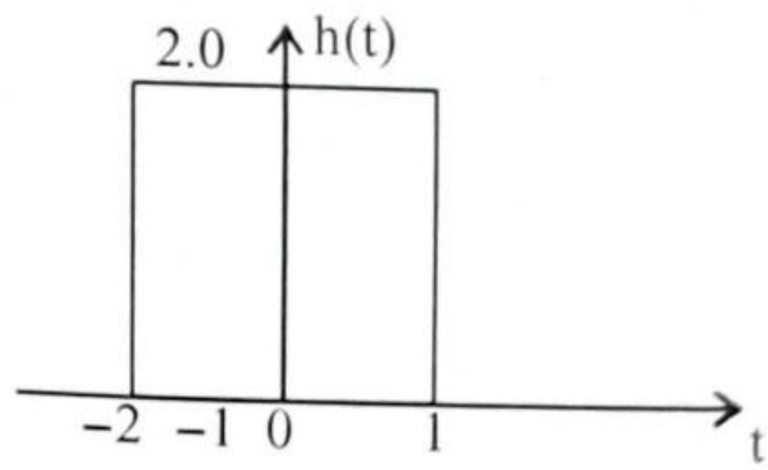
(i) $x(t) = e^{-2t}\,u(t)$; $x(t) = 4\,(t+2)$

(ii) $x(t) = e^{-|t|}$; $x(t) = e^{-2\,(t+1)}\,u(t+1)$

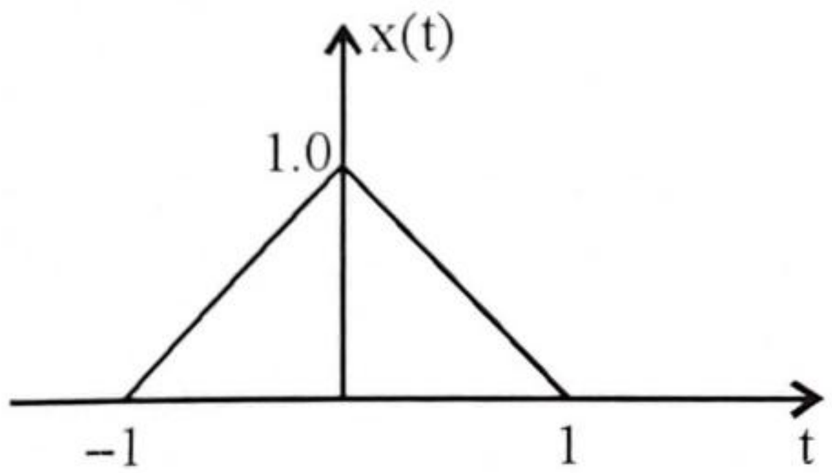
(iii) $x(t) = u(t+1)$; $x(t) = u(t-2)$

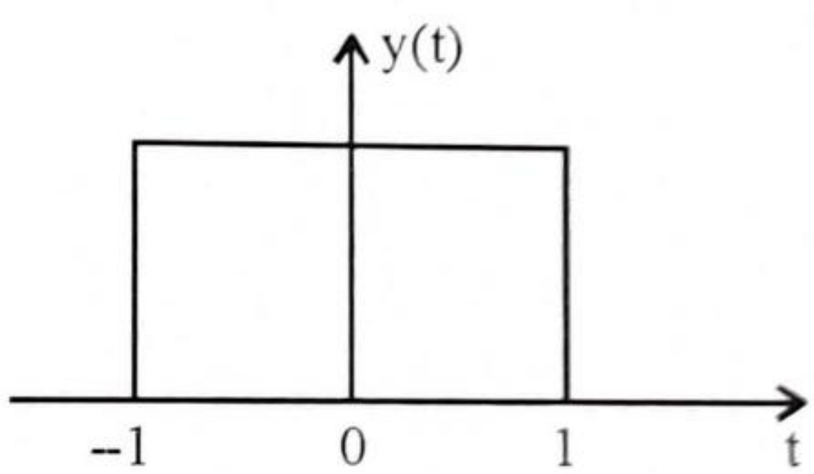
(b) Find the response y (t) of an LTI system whose x (t) and n (t) are shown in figure using convolution integral :





(c) Find the cross-correlation between triangular pulse and gate pulse as shown below :





5. (a) Find the Fourier transform of the following sketch the magnitude and phase spectrum :

(i) $x(t) = \delta(t)$

(ii) $x(t) = e^{-at}\, 4(t)$

(iii) $x(t) = e^{2t}\, u(t)$

(b) Find the inverse Fourier transform of the following :

(i) $\delta(\Omega)$

(ii) $\delta(\Omega - \Omega_0)$

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(c) Obtain the impulse response of the system described by :

$$H(e^{jw}) = 1 \quad \text{for} \quad |w| \leq w_c$$
$$= 0 \quad \text{for} \quad w_c \leq |w| \leq \pi$$

6. (a) Find the cross-correlation of two finite length sequences :

$$x(n) = \{1, 2\ 1, 1\};\ y(n) = \{1, 1, 2, 1\}$$

(b) What are the properties of the following :

(i) Auto correlation function

(ii) Cross correlation function

(c) What is the overall impulse response h (n) when two systems with impulse responses h_1 (n) and h_2 (n) are in parallel and in series?

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