[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 2382 **F–4** **Your Roll No.....**

Unique Paper Code : 2511402

Name of the Course : **B. Tech Electronics**

Name of the Paper : Signals and Systems

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsiory.
3. Attempt **five** questions in all.
4. Use of non-programmable scientific calculator is allowed.

1. (a) Draw the signal $x[n] = u[n+2] + u[n-4]$. (3×5=15)

   (b) Determine whether the given signal is periodic or not : $x(t) = \cos^2(t/4)$. If periodic, then calculate the fundamental period.

   (c) Determine if following system is LTI system or not : $y(t) = x(t+1) - x(t-1)$. Justify your answer.

   (d) Compute using Laplace Transform the output y(t) for a continuous time LTI system whose impulse response h(t) and the input x(t) are given by $h(t) = \delta(t)e^{-\alpha t}$ and $x(t) = \delta(-t)e^{\alpha t}$, with $\alpha > 0$.

   (e) The continuous time system consists of one differentiator, and one scalar multiplier. Write a differential equation that relates y(t) and input x(t) :

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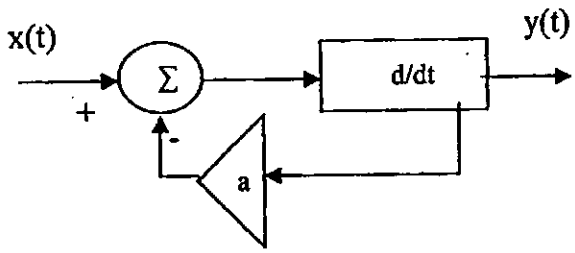


2. (a) Determine if following systems are causal or non-casual :

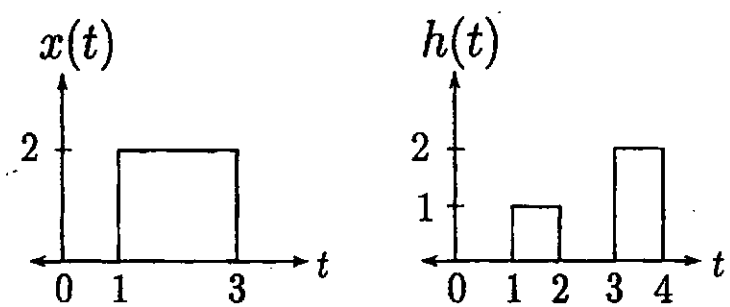
$y[n] = x[2-n]$. (5)

(b) A particular system may be or may not be memory less, time-invariant, linear, causal and stable. Comment, about the given systems on above properties :

(i) $y[n] = nx[n]$

(ii) $y(t) = x(t)\cos(\omega t)$ (10)

3. (a) Two continuous-time signals are shown in the figure below. Calculate the convolution integral of x(t) and h(t) and draw the sketch. (8)



(b) Explain scalar multiplicative and additive properties of superposition principle for a linear system. (3)

(c) Prove associative property for a generic LTI system. (4)

4. (a) Consider the difference equation y[n] = ay[n–1] + x[n], where '*a*' is a constant. Give its block diagram. (8)

(b) Consider a time invariant system with input x(t) and output y(t). Show that if x(t) is periodic with period T, then so is y(t). (7)

5. (a) Find the inverse Laplace Transform of the system function :

$H(s) = 1/(s^2+1)$. (3)

(b) Consider a series RLC circuit, with an initial voltage on the capacitor as $V_0 = 0$. A d.c. voltage V is applied at t=0. Find the current i(t) and the voltage across the capacitor v_c using Laplace Transform. (7)

(c) The output y(t) of a continuous time LTI system is found to be $2u(t)e^{-3t}$ when the input x(t) is unit impulse function. Find the impulse response h(t) of the system and the output y(t) when the input $x(t) = u(t)e^{-t}$ using Laplace transform. (5)

6. (a) Find the even and odd part of the signal x[n] = u[n] – u[n + 1]. Label the sketches carefully. (5)

(b) Determine the value of P_∞ and E_∞ for $x[n] = 2(e)^{3jn}$. (5)

(c) Draw the pole-zero diagram for system function $H(s) = \frac{1}{(s+1)(s+2)}$ and draw the region of convergence assuming it to be a stable system. (5)

7. Write short notes on the followings :

(a) Causality criteria of an LTI system

(b) ROC of Laplace Transform

(c) Product of even and odd signals (3×5)