[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1080 **E** **Your Roll No.....**

Unique Paper Code : 251201

Name of the Course : **B.Sc. (H) Electronics (ELHT–201)**

Name of the Paper : Signals & Systems

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

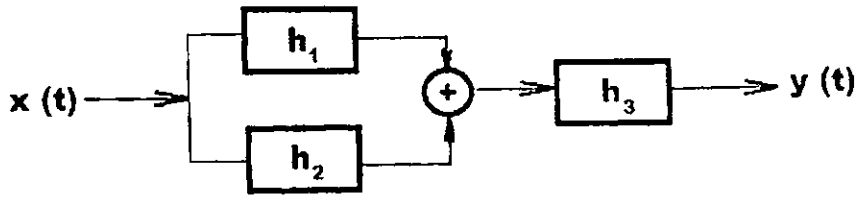
1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FIVE** questions in all.
3. Question No. 1 is compulsory.
4. **All** questions carry equal marks.
5. Use of Scientific non-programmable calculator is allowed.

1. Attempt all the **five** questions : (3×5)

   (a) State the conditions that need to be satisfied for system to be linear.

   (b) Check and justify whether the system, $y(t) = x(t^2)$ is causal.

   (c) Express the overall impulse response h(t) of the LTI system in terms of h_1, h_2 and h_3. State the properties used to deduce the same.

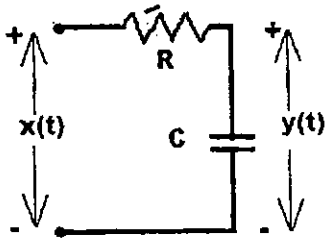


P.T.O.

(d) Find the Continuous Time Fourier Series (CTFS) coefficients of the continuous time periodic signal :

$$x(t) = 1 + \cos\left(3\omega_0 t + \frac{\pi}{3}\right)$$

(e) Find the impulse response of given circuit assuming initial conditions to be zero.

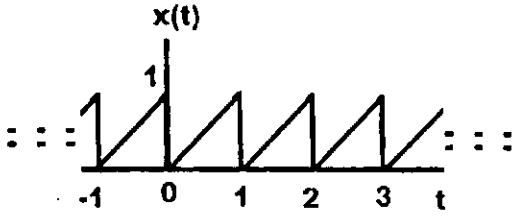


2. (a) Determine the fundamental period (N_0) for the signal so that it becomes periodic.

$$x[n] = \cos\left(\frac{\pi}{8}n^2\right) \quad (4)$$

(b) Plot x(t), x(2t – 1) and $\frac{d}{dt}x(t)$ when x(t) = u(t) + 2u(t – 1) – 3u(t – 3). (6)

(c) Calculate the energy (E) and the power (P) of the periodic signal x(t) as shown below. Also state whether it is an energy or power signal. (5)



3. (a) Plot y(t) = x(t) * δ(t + 2) when x(t) = u(t + 2) – u(t – 2). (4)

(b) State and justify whether a LTI system with impulse response as h[n] = 3^nu[3 – n] is stable and/or causal. (5)

(c) Determine the impulse response for cascade of two LTI systems having impulse responses h_1 = u(t – 2) – u(t – 4) and $h_2 = e^{-2t}u(t)$. (6)

4. (a) Find the expression for the output y[n] of the discrete time system having

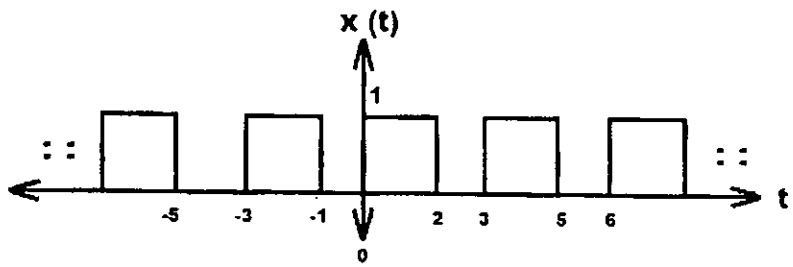
$$x[n] = h[n] = \alpha^n u[n]. \quad (5)$$

(b) Determine the step response of the system whose impulse response is

$$h(t) = \frac{1}{2} e^{-t/4}\, u(t) \quad (4)$$

(c) Plot the magnitude and phase spectrum for continuous time signal $x(t) = e^{-at}u(t)$, $a > 0$ using Continuous Time Fourier Transform (CTFT) of signal. (6)

5. (a) Determine the Continuous Time Fourier Series (CTFS) coefficients for the periodic signal x(t).



(6)

(b) Differentiate between the recursive and non-recursive filters. (4)

(c) State and prove the time shifting property for Continuous Time Fourier Transform. (5)

6. (a) Use the CTFT of signals to determine the impulse response of system described by linear differential equation.

$$\frac{dy}{dt} + 2y(t) = x(t) \quad (5)$$

(b) Determine signal x(t) when

$$X(s) = \frac{4}{(s+2)(s+4)};\ -2 > \mathrm{Re}(s) > -4 \quad (5)$$

c) Determine the transfer function H(s) of a system, using Laplace transform, when its impulse response is

$$h(t) = \frac{1}{t}\left(1 - e^{t}\right) \qquad (5)$$

7. (a) Prove the following identities :

(i) $x_1(t) * x_2(t) \leftrightarrow X_1(s)\, X_2(s)$ (5)

(ii) $e^{at} x(t) \leftrightarrow X(s - a)$ (4)

(b) Find current i(t) in an electric circuit if it is governed by

$$\frac{d^2}{dt^2} i(t) + 9i(t) = \cos 2t$$

and given that i(0) = 1 amp, i(π/2} = −1 amp. (6)