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[5252]-531

S.E. (E&TC/Electronics) (First Semester) EXAMINATION, 2017

SIGNALS AND SYSTEMS

(2015 PATTERN)

Time : Three Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(iv) Assume suitable data, if necessary.

1. (a) Sketch the following signals : [6]

(i) $u[n + 2] - u[n - 3]$

(ii) $r(t) u(2 - t)$.

(a) Find the convolution of $x(t)$ and $h(t)$: [6]

$x(t) = u(t + 1)$

$h(t) = u(t - 2)$.

Or

2. (a) Check whether the following system is static/dynamic, linear/non-linear, causal/non-causal, time variant/time invariant : [4]

$$y(t) = 10x(t) + 5.$$

(b) Check whether the following signal is periodic or non-periodic.

If periodic, find the fundamental time period [2]

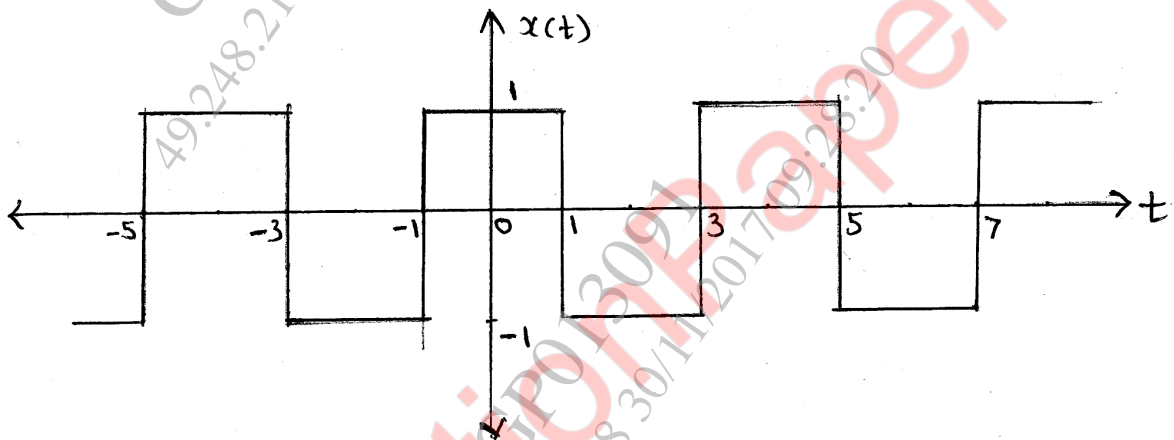
$$x(t) = 2 \cos (10t + 1) - \sin (4t - 1)$$

P.T.O.

- (c) Determine the convolution sum of two sequences graphically : [6]

$$\begin{array}{ccc}
 x[n] = \{1, 2, 3, 2\} & & h[n] = \{1, 2, 2\} \\
 \uparrow & & \uparrow
 \end{array}$$

3. (a) Find the trigonometric Fourier series for the periodic signal $x(t)$. [6]



- (b) Obtain the Fourier transform of a rectangular pulse : [6]
 $x(t) = A \text{ rect } (t/T).$

Or

4. (a) Obtain the exponential Fourier series of the unit impulse train

$$x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT_0)$$

Sketch the Fourier spectrum. [6]

- (b) Find the Fourier transform of the following signals : [6]

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

(ii) $x(t) = e^{-at} u(t).$

5. (a) Find the Laplace transform of :

$$x(t) = e^{-5t} [u(t) - u(t - 5)] \text{ and its ROC} \quad [7]$$

- (b) Find the initial and final values for the following function : [6]

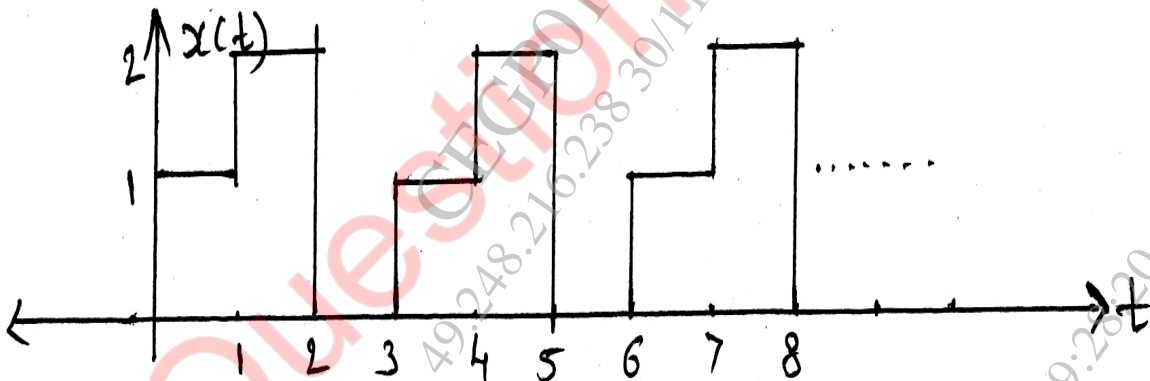
$$x(s) = \frac{s+5}{s^2+3s+2}$$

Or

6. (a) Determine the inverse Laplace Transform of : [7]

$$x(s) = \frac{2}{s(s+1)(s+2)}$$

- (b) Find Laplace transform of given periodic signal : [6]



7. (a) In a random experiment, a trial consists of four successive tosses of a coin. If we define a random variable x as the number of heads appearing in a trial, determine PDF and CDF. [7]

- (a) State and prove any *three* properties of PDF. [6]

Or

8. (a) A certain random variable has the CDF given by : [7]

$$\begin{aligned}F_x(x) &= 0 \text{ for } x \leq 0 \\ &= kx^2 \text{ for } 0 < x \leq 10 \\ &= 100k \text{ for } x > 10.\end{aligned}$$

Find the values of :

- (i) k
 - (ii) $P(x \leq 5)$
 - (iii) $P(5 < x \leq 7)$
 - (iv) Plot the corresponding PDF.
- (b) State and explain the properties of auto-correlation function for energy signal. [6]