Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[5459]-131

S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2018

SIGNALS AND SYSTEMS

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Attempt *four* questions as Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Perform the following operations on the given signal $x(t)$ which is defined as : [4]

$$x(t) = u(t + 4)$$

(1) Sketch $z(t) = x(-t - 1)$

(2) Sketch $y(t) = x(t) + z(t)$.

(*b*) Write the expression for energy and power of the signal. Also determine whether the following signals is Energy or Power, and find energy or time averaged power of the signal : [4]

$x(t) = 5\cos(10\pi t) + \sin(20\pi t); \quad -\infty \leq t \leq \infty.$

P.T.O.

(*c*) Determine whether the following system is Static/Dynamic, Causal/Non-causal and Stable/Unstable and justify : [5]

$$h(t) = e^{-10t}u(t).$$

Or

2. (*a*) Compute the convolution integral by graphical method and sketch the output for the following signals : [5]

$$x(t) = u(t)$$

$$h(t) = e^{-2t}u(t).$$

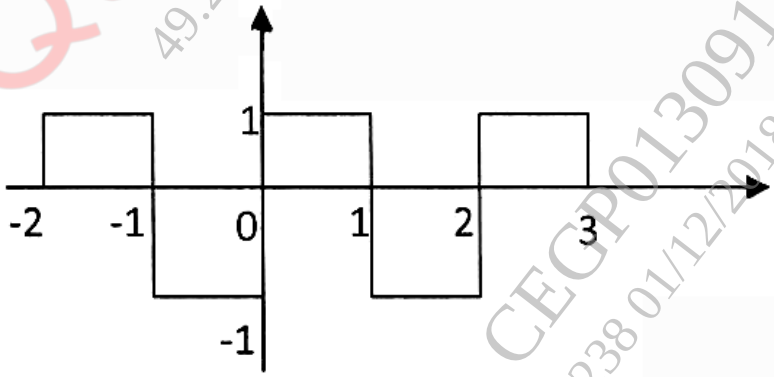
(*b*) Check whether the following signal is even or odd and determine the even and odd part of the signal : [4]

$$x(t) = u(t).$$

(*c*) Compute the convolution integral for the following signal : [4]

$x(t) = u(t)$, $h(t) = \delta(t + 1) + \delta(t) + \delta(t - 1)$.

3. (*a*) Find the trigonometric Fourier series for the periodic signal $x(t)$ shown in the following figure : [6]



(*b*) State any *six* properties of Fourier transform. [6]

Or

4. (*a*) Find the Fourier transform of the following signals : [6]

(1) $x(t) = \text{sng}\,(t)$

(2) $x(t) = \cos(\omega_0 t)\ u(t)$.

(*b*) Write expression for Trigonometric Fourier series and Exponential Fourier series. [4]

(*c*) Define amplitude and phase spectra of the signal. [2]

5. (*a*) Find the inverse Laplace transform of [6]

$$X(s) = \frac{2}{(s+4)(s-1)}$$

If the Region of convergence is :

(1) $-4 \leq Re(s) < 1$

(2) $Re(s) > 1$

(3) $Re(s) < -4$.

(*b*) A signal $x(t)$ has Laplace transform : [6]

$$X(s) = \frac{s+2}{s^2+4s+5}$$

Find the Laplace transform of the following signals :

(1) $y_1(t) = tx(t)$

(2) $y_2(t) = e^{-t}\,x(t)$.

Or

6. (*a*) Find the Laplace transform of the following signal and sketch ROC : [6]

$$x(t) = e^{-3t}u(t) + e^{-5t}u(t).$$

(*b*) Find the initial and final value of the following signal : [4]

$$X(s) = \frac{2s + 3}{s^2 + 5s - 7}.$$

(*c*) State the relationship between Fourier transform and Laplace transform. [2]

7. (*a*) Find the following for the given signal $x(t)$: [6]

(*i*) Autocorrelation

(*ii*) Energy from Autocorrelation

$$x(t) = e^{-10t}u(t).$$

(*b*) Define Probability and state the properties of PDF. Also state the relationship between CDF and PDF. [7]

Or

8. (*a*) Suppose a certain random variable has CDF : [7]

$$F_x(x) = 0, \quad x \leq 0$$

$$F_x(x) = kx^2, \quad 0 < x \leq 10$$

$$F_x(x) = 100k, \quad x > 10$$

Calculate K. Find the values of $P(X \leq 5)$ and $P(5 < X \leq 7)$.

(*b*) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X, which represents the number of heads obtained on any tripple toss. Also find the probabilities of X and plot the C.D.F. [6]