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

Seat No.	

[5152]-131

S.E. (Electronics/E&TC) (I Sem.) EXAMINATION, 2017
SIGNALS AND SYSTEMS
(2012 PATTERN)

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

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.
(*ii*) Figures to the right indicate full marks.
(*iii*) Assume suitable data, if necessary.

1. (*a*) Check whether the following signals are periodic or aperiodic. Find period if periodic. [6]

(1) $x[n] = \cos(7n)$

(2) $x(t) = 5\sin\frac{2\pi t}{7} + 10\cos\frac{2\pi t}{9}$.

(*b*) Check whether the following systems with impulse responses are : [6]

(1) Static/dynamic

(1) Causal/non-causal

(3) Stable/unstable

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

(*ii*) $h(n) = \cos n\pi$.

Or

2. (*a*) For the signal given in Figure No. 1, perform the following operations and sketch the resulting signals : [6]

(1) $\int_{-\infty}^{t} x(t)\,dt$

(2) $\frac{d}{dt}\, x(t)$

(3) $x(3t+2)$.

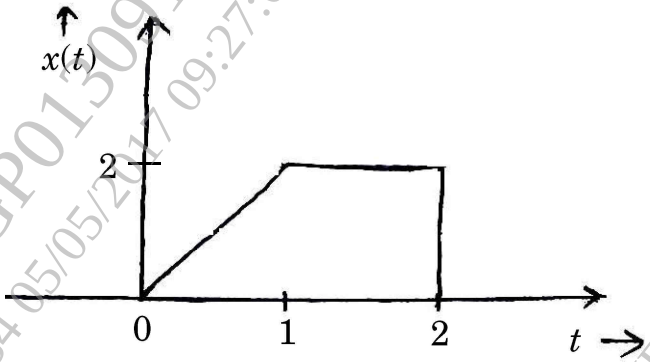

Fig. No. 1

(*b*) State and prove the following properties of convolution integral : [6]

(1) Commutative

(1) Distributive

(3) Associative.

3. (*a*) Determine the trignometric Fourier series of the signal shown in Fig. No. 2. [6]

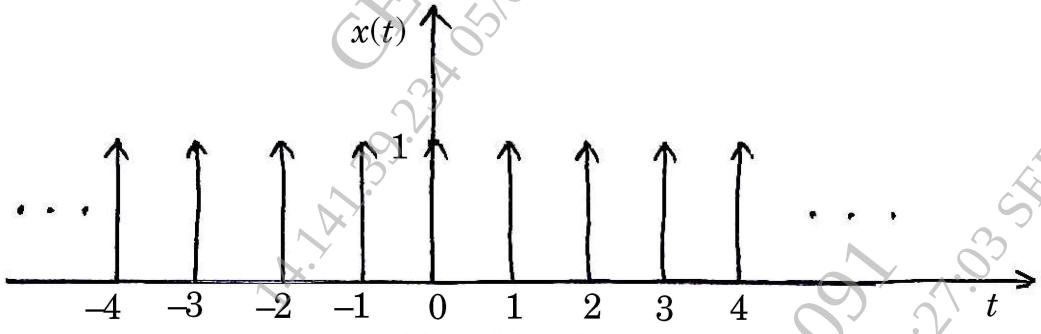

Fig. No. 2

(*b*) Determine inverse Laplace transform of : [6]

$$X(s) = \frac{2s+5}{s(s+1)(s+3)}$$

If :

1. R.O.C. is $R_e(s) > 0$
2. R.O.C. is $R_e(s) < -3$

Or

4. (*a*) Determine frequency response of the system wtih impulse response given by : [6]

$$h(t) = e^{-3t}u(t)$$

Obtain $|H(j\omega)|$ and $\angle H(j\omega)$

(*b*) Determine initial and final values of the signal having Laplace transform : [6]

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

5. (*a*) State and prove any *three* properties of autocorrelation of an energy signal. [6]

(*b*) Determine power spectral density (PSD) of the given signal and determine its power using the relation between PSD and power. [7]

$$x(t) = A \sin \omega_0 t$$

Or

6. (*a*) Determine autocorrelation of the sequence : [6]

$$x[n] = \{1, 2, 1, 1\}$$
$$\uparrow$$

Also verify that its energy E is,

$$E = R_{xx}[0].$$

(*b*) Determine autocorrelation of the signal : [7]

$$x(t) = A \text{ rect}\left(\frac{t}{2}\right)$$

Also determine its energy from autocorrelation.

7. (*a*) Define and explain the following : [6]

(1) Sample space

(2) Cumulative distribution function (CDF)

(3) Mean square value.

(*b*) For a probability density function (PDF) given below : [7]

$$f_X(x) = kx^2, \quad 0 \le x \le 1$$
$$= kx, \quad 1 \le x \le 2$$
$$= 0, \quad \text{otherwise}$$

Determine L, CDF, $P(X \ge 1)$, $P(X < 2)$.

Or

8. (*a*) For a PDF given by : [6]

$$f_X(x) = e^{-x}, \quad x \ge 0$$
$$= 0, \quad \text{otherwise}$$

determine mean, mean square and variance.

(*b*) A binary source generates digit '1' and digit '0' randomly with equal probability. Determine the probabilities of the following events : [7]

(1) There are exactly two 1's and eight 0's

(2) There are at least four 0's.

Also determine the number of events in the sample space.