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

Seat No.	

[5152]-531

S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2017
SIGNALS AND SYSTEMS
(2015 PATTERN)

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

N.B. **:—** (*i*) Attempt 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*) Figures to the right indicate full marks.

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

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

1. (*a*) Find whether the following signals are energy or power and find the corresponding value : [4]

$$x(t) = \cos(t).$$

(*b*) Determine whether the following LTI system described by impulse response $h(t) = e^{-t}\, u(t+1)$ is stable and causal. [4]

(*c*) Find odd and even components of the following signals : [4]

$$x[n] = \{1,\ 0,\ -1,\ 2,\ 3\}$$

Or

2. (*a*) An analog signal is given by the equation : [2]

$$x(t) = 2 \sin 400\ \pi t + 10 \cos 1000\ \pi t.$$

It is sampled at sampling frequency 1000 Hz :

(*i*) What is the Nyquist rate for the above signal ?

(*ii*) What is the Nyquist interval of the signal ?

P.T.O.

(*b*) Determine the convolution sum of the following sequence using equation of convolution sum : [6]

$$x(n) = \delta(n) + 2\delta(n - 2)$$

$$h(n) = 2\delta(n) - \delta(n - 2).$$

(*c*) Check whether the following singal is periodic or non-periodic. If periodic, find period of the signal : [4]

$$x(t) = 10 \sin 12\pi t + 4 \sin 18\pi t.$$

3. (*a*) State and prove the following properties of CTFT : [6]

(*i*) Time scaling

(*ii*) Time shifting.

(*b*) Obtain the trigonometric Fourier series of the rectangular pulse shown in Fig. 1 : [6]

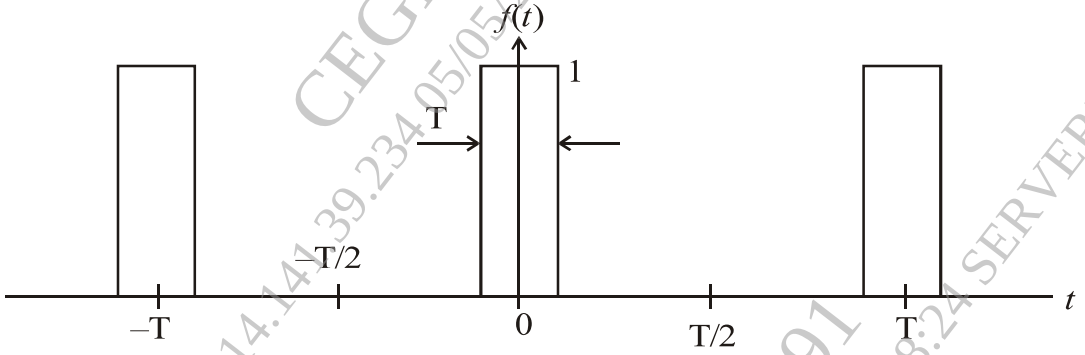

Fig. 1

Or

4. (*a*) State the Dirichlet conditions for existence of Fourier series. [4]

(*b*) For the sinc function shown in Fig. 2, obtain Fourier transform and plot its spectrum : [8]

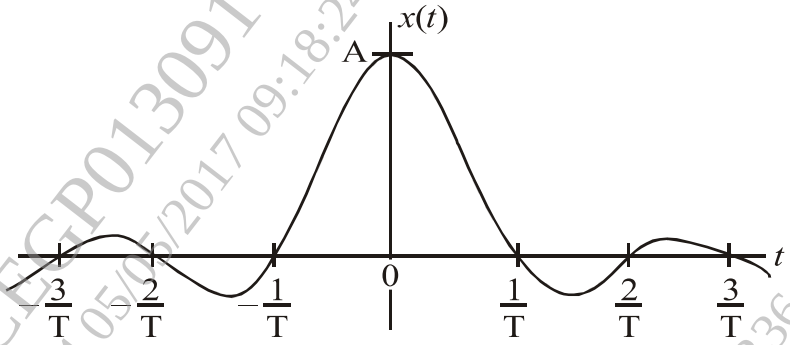

Fig. 2

5. (*a*) Find the initial and final value of a signal : [6]

$$X(s) = (s + 10)/(s^2 + 2s + 2).$$

(*b*) Find the inverse Laplace transform of : [7]

$$X(s) = -5s - 7/(s + 1)(s - 1)(s + 2).$$

Or

6. (*a*) Find the Laplace transform of the following with ROC : [7]

(*i*) $x(t) = u(t - 5)$

(*ii*) $x(t) = e^{-at} \sin(\omega t)\, u(t).$

(*b*) The differential equation of the system is given by : [6]

$$dy(t)/dt + 2y(t) = x(t).$$

Determine the output of system for $x(t) = e^{-3t}\, u(t)$. Assume zero initial condition.

7. (*a*) What is correlation ? Explain the *two* types of correlations with a practical application for each. [6]

(*b*) The PDF of a random variable x is given by : [7]

$$f_x(x) = 1/2\pi \quad \text{for } 0 \leq x \leq 2\pi$$
$$= 0 \quad \text{otherwise.}$$

Calculate mean value, mean square value, variance and standard deviation.

Or

8. (*a*) In a pack of cards, 2 cards are drawn simultaneously. What is the probability of getting a queen, jack combination ? [6]

(*b*) Supose that a certain random variable has a CDF : [7]

$$F_x(X) = 0 \quad \text{for } x \leq 0$$
$$= kx^2 \quad \text{for } 0 \leq x \leq 10$$
$$= 50k \quad \text{for } x > 10$$

(*i*) Determine the value of k

(*ii*) $P(4 \leq x \leq 7)$

(*iii*) Find and sketch PDF.