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

Seat No.	

[5057]-242

S.E. (E&TC/Electronics) (First Semester)

EXAMINATION, 2016

SIGNALS AND SYSTEMS

(2012 PATTERN)

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

N.B. **:—** (*i*) Attempt Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

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

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

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

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

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

(*b*) Determine whether the following signal is periodic and find fundamental period : [2]

$$x(t) = \cos^2(2\pi t).$$

(*c*) Compute the convolution integral by graphical method and sketch the output for : [6]

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

P.T.O.

Or

2. (*a*) Find whether the following signal is energy or power. Also compute corresponding value : [3]

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

(*b*) Determine whether the following system is memoryless, causal and stable : [3]

$$y(t) = e^{t\, x(t)}.$$

(*c*) An LTI system has the inpulse response : [6]

$$h(t) = u(t+1) - u(t-3)$$

Determine whether the system is causal, stable and static.

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

(*i*) Frequency shift

(*ii*) Convolution in time.

(*b*) Obtain the initial and final values of the following function : [6]

$$\mathrm{X}(s) = \frac{2s+3}{s^2+5s+6}.$$

Or

4. (*a*) Obtain the Fourier transform of a rectangular pulse : [6]

$$x(t) = \mathrm{A\ rect}\ (t / \mathrm{T}).$$

(*b*) Find the inverse Laplace transform of the function : [6]

$$\mathrm{X}(s) = \frac{1}{s^2+3s+2}.$$

5. (*a*) Find the autocorrelation of the following signal : [4]

$$x[n] = [4, 3, 2, 1]_{\uparrow}.$$

(*b*) State the the properties of ESD. [3]

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

(*i*) Autocorrelation

(*ii*) Energy from Autocorrelation

(*iii*) Energy spectral density.

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

Or

6. (*a*) Determine cross-correlation between two sequences given below : [8]

$$x_1[n] = \{1, 2, 3, 4\}_{\uparrow}$$

$$x_2[n] = \{3, 2, 1, 0\}_{\uparrow}.$$

(*b*) State and explain properties of autocorrelation function of energy signal. [5]

7. (*a*) State and prove properties of CDF. [5]

(*b*) The probability density function of a random variable X is given by : [8]

$$f_X(x) = x\, e^{-x}\, u(x)$$

Determine :

(*i*) CDF

(*ii*) $P(X \leq 1)$

(*iii*) $P(1 < X \leq 2)$

(*iv*) $P(X > 2)$.

Or

8. (*a*) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X represents the number of heads on any triple toss. Calculate and draw the CDF and PDF. [8]

(*b*) PDF of a random variable X is given by $f_X(x) = e^{-x}$ for $x \geq 0$, then find : [5]

(*i*) Mean E[X]

(*ii*) Mean square $E[X^2]$.