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

Seat No.	

[4757]-152

S.E. (Electronics/E&TC) (II Sem.) EXAMINATION, 2015

SIGNALS AND SYSTEM

(2008 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.

(*v*) Use of calculator is allowed.

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

(*i*) $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$

(*ii*) $x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$.

(*b*) For each of the following signals, determine whether it is periodic, and if it is, find the fundamental period : [4]

(*i*) $x(t) = 8\sin(400\pi t)$

(*ii*) $x(t) = 5 + t^2$.

(*c*) Find $y(n)$, discrete time signal convolution integral. If, [4] $x(n) = [u(n) - u(n-4)]$ and $h(n) = \{2, 2, 2, 2\}$.

P.T.O.

Or

2. (*a*) For the following system, determine whether it is : [3]

(*i*) Memoryless

(*ii*) Stable

(*iii*) Causal

$$y(t) = x(3 - t).$$

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

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

(*c*) Sketch the waveform of the following signal, [3]

$$y(t) = r(t + 1) - r(t) + r(t - 2).$$

3. (*a*) Find the Fourier transform of the following signals, [6]

(*i*) $x(t) = 2[u(t) - u(t - 4)]$

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

(*b*) State and prove the following properties of the Laplace transform : [6]

(*i*) Time shifting

(*ii*) Initial value theorem

(*iii*) Final value theorem.

Or

4. (*a*) Show that rectangular function in time domain to become Sinc function in frequency domain. [6]

(*b*) Find the Laplace transform of the following signals using properties of Laplace transform : [6]

(*i*) $x(t) = u(t - 3)$

(*ii*) $x(t) = t^2 \ e - 3t \ u(t)$.

5. (*a*) Prove that for an energy signal $x(t)$ the Autocorrelation function and energy spectral density form Fourier Transform pair. [7]

(*b*) State and explain all the properties of energy spectral density [ESD]. [6]

Or

6. (*a*) State and explain all the properties of probability, CDF and PDF. [8]

(*b*) Determine the cross correlation between two sequences given below : [5]

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

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

7. (*a*) Probability density function of a Random variable x is defined by : [7]

$$fx(x) = \begin{cases} K(1 - x^2), & 0 \leq x \leq 1 \\ 0 \quad , & \text{elsewhere} \end{cases}$$

Find :

(*i*) k

(*ii*) CDF

(*iii*) $P(0 \leq x \leq 2)$.

(*b*) Explain Gaussian probability model with respect to its density and distribution function. [6]

Or

8. (*a*) CDF of a certain Random variable is given by : [7]

$$Fx(x) = \begin{cases} 0 & x \leq 0 \\ Kx^2 & 0 < x \leq 10 \\ 100K & x > 10 \end{cases}$$

(*i*) Find the value of K.

(*ii*) Determine PDF.

(*iii*) Find the values of Probabilities P($x \leq 5$); P($x > 11$).

(*b*) A student arrives late for a class 30% of the times. Class meets 5 times a week. Then find : [6]

(*i*) Probability of student being late for at least three classes in a given week.

(*ii*) Probability of student being late for two classes in a given week.

(*iii*) Probability of student will not be late at all during a given week.