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

Seat No.	

[5252]-131

S.E. (E&TC/Electronics) (First Semester) EXAMINATION, 2017

SIGNALS AND SYSTEMS

(2012 PATTERN)

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

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

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

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

(*iv*) Neat diagrams should be drawn wherever necessary.

(*v*) Use of electronic non-programmable calculator is allowed.

1. (*a*) Find the time shifted signal : [4]

$y[n] = x[n + 4]$

$$x[n] = \begin{cases} 1 & n = 1, 3 \\ -1 & n = -1, -2 \\ 0 & n = 0, 2 \end{cases}$$

(*b*) Find whether the following signals are periodic or not. If periodic, calculate the fundamental period : [4]

(*i*) $x[t] = \sin 200\ \pi t + 2\cos 100\,\pi t$

(*ii*) $x[n] = \sin \dfrac{62n}{10}$

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(*c*) Determine whether the following system is Static/Dynamic, Linear/non-linear causal/non-causal and stable/unstable [4]

$$y(t) = x^2(t).$$

Or

2. (*a*) Determine and sketch, even and odd components of the following signals : [4]

(*i*) $x[n] = e^{-(n/4)}\ u[n]$

(*ii*) $x(t) = 1,\ 0 \leq t \leq 4.$

(*b*) Determine whether the following signals are energy signals, power signals or neither : [4]

(*i*) $x(t) = e^{-at}\ u(t),\ a > 0$

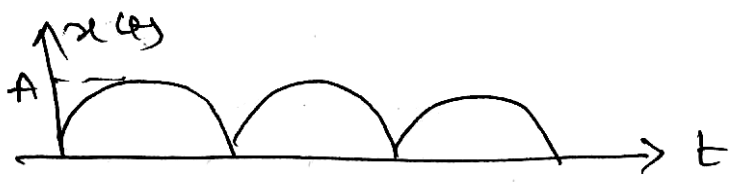
(*ii*) $x(t) = t.u(t).$

(*c*) Determine the stability and causality for the LTI system with the following impulse responses : [4]

(*i*) $h(t) = e^{-t}u(t - 1)$

(*ii*) $h[n] = \cos\ [n]u[n].$

3. (*a*) Find the quadrature Fourier series for the full wave rectified sine wave as shown in Fig. [6]



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(*b*) Using properties of Laplace transform, find : [6]

(*i*) $x(3t)$

(*ii*) $x(t - 2)$, if $X(s) = \frac{2s}{s^2 + 2}$.

Or

4. (*a*) Calculate Laplace transform of $x(t) = e^{-2t}\, u(t) - e^{2t}\, u(-t)$ and plot ROC. [6]

(*b*) Find initial and final value of : [6]

(*i*) $X(s) = \frac{0.8}{s(s^2 + 0.6s + 0.2)}$

(*ii*) $\frac{1}{s+1}$.

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

(*i*) Autocorrelation

(*ii*) Energy from $x(t)$ and Autocorrelation

(*iii*) Energy spectral density $x(t) = e^{-4t}\, .u(t)$.

(*b*) Define energy spectral density and prove relation between Autocorrelation and ESD. [4]

(*c*) Plot the correlogram for the sequences $x[n]$ and $y[n]$ given below : $x[n] = u[n]$; $y[n] = u[n - 4]$. [3]

Or

6. (*a*) State and describe properties of Autocorrelation function of CT energy signals. [6]

(*b*) Find the cross correlation by analytical method of the following signals : [7]

$x_1[n] = \{4, 3, 2, 1\}$, $x_2[n] = \{3, 2, 1, -1\}$.
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7. (*a*) Probability Density Function (PDF) of a random variable X is given by : [7]

$$f_x(X) = \begin{cases} k(1-X^2) & 0 \le X \le 1 \\ 0 & \text{otherwise} \end{cases}$$

Then find (1) k (2) CDF (3) $P(0 \le X \le 2)$.

(*b*) There are four white shirts and five black shirts inside a bag. What is the probability of drawing a white shirt from a bag ? [4]

(*c*) State the significance of standard deviation. [2]

Or

8. (*a*) State the properties of probability distribution function. [6]

(*b*) With example, explain the concept of Continuous Random Variable and Discrete Random Variable. What is the CDF and PDF ? Plot PDF of uniform distributed random variable over an interval (0 to 2π). [7]

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