Seat No.

[5668]-131

S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2019

SIGNALS AND SYSTEMS

(2015 PATTERN)

Time : Two Hours　　　　　　　　　　Maximum Marks : 50

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

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

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

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

1. (*a*) Check whether the following systems are Causal, Time variant and Linear and Justify. [6]

　　(1)　$x^2(t) + x(t+2)$

　　(2)　$Ax(n) + B$.

(*b*) Sketch the waveforms for the following signals : [4]

　　(1)　$x(t) = u(t+1) - 2u(t) + u(t-1)$

　　(2)　$x(t) = \sum_{k=-\infty}^{k=\infty} \delta(t - 2k)$.

(*c*) Check whether the following system is stable/unstable, causal/ Non-causal and static/dynamic whose impulse response is :

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

Also justify the same. [3]

2. (*a*) Find the step response of systems whose impulse responses are given by : [4]

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

(2) $h(t) = \delta(t) - \delta(t-1)$.

(*b*) Compute the convolution integral by graphical method and sketch the output for : [5]
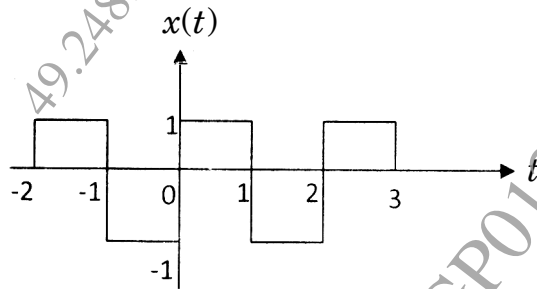
$$x_1(t) = u(t-2) \qquad h(t) = u(t)$$

(*c*) Determine whether the following signal is periodic or not, if periodic find the fundamental period of the signal : [4]

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

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

3. (*a*) Find the Trigonometric/Exponential Fourier series for the periodic signal $x(t)$. Sketch the amplitude and phase spectra. [6]

(*b*) Find the Fourier transform of $x(t) = rect\left(\dfrac{t}{\tau}\right)$ and sketch the magnitude and phase spectrum. [6]

4. (*a*) State the dirichlet conditions for existence of Fourier transform. [3]

(*b*) Find the Fourier transform of : [6]

(1) $x(t) = \cos(\omega_0 t)$

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

(*c*) Explain Gibb phenomenon. [3]

5. (*a*) If

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

find Laplace Transform of :

(1) $\dfrac{d}{dt}(x(t))$

(2) $tx(t)$. [6]

(*b*) Find inverse Laplace Transform of $X(s) = \dfrac{3s^2 + 8s + 6}{(s+2)(s^2 + 2x + 1)}$. [6]

6. (*a*) Find the unilateral Laplace transform of : [6]

(1) $\delta(t)$

(2) $x(t) = \cos(\omega_0 t)$

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

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

(1) Differentiation in time domain

(2) Convolution in time domain

(3) Time shifting.

7. (*a*) State any *three* properties of Autocorrelation signals. [3]

(*b*) Explain Gaussian probability model with respect to its density and distribution function. [4]

(*c*) Find the mean, second moment and standard deviation of X, if pdf, $f_x(X) = e^{-\Lambda x}u(x)$. [3]

(*d*) A box contains 10 white, 15 red and 15 black balls. A ball is drawn at random find the probability that it is : [3]

(1) Red

(2) Not black

(3) Black or white.

Or

8. (*a*) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X, which represents the number of heads obtained on any tripple toss. Also find the probabilities of X and plot the C.D.F. [7]

(*b*) Suppose a certain random variable has CDF : [6]

$F_x(x) = 0, \quad x \le 0$

$F_x(x) = kx^2, \quad 0 < x \le 10$

$F_x(x) = 100k, \quad x > 10$

Calculate K. Find the values of $P(X \le 5)$ and $P(5 < X \le 7)$.