

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[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]

P.T.O.

Or

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]

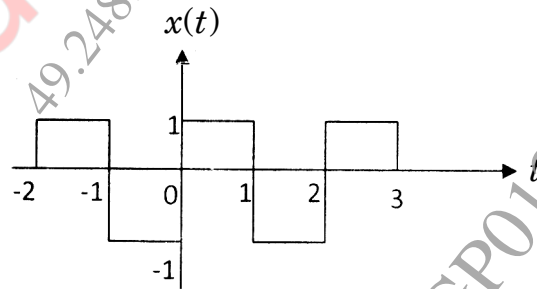
$x_1(t) = u(t-2)$ $h(t) = u(t)$

- (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 $x(t) = \text{rect}\left(\frac{t}{\tau}\right)$ and sketch the magnitude and phase spectrum. [6]

Or

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

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

find Laplace Transform of :

- (1) $\frac{d}{dt} (x(t))$
- (2) $tx(t)$. [6]
- (b) Find inverse Laplace Transform of $X(s) = \frac{3s^2 + 8s + 6}{(s+2)(s^2 + 2s + 1)}$. [6]

Or

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, $f_x(X) = e^{-Ax}u(x)$. [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]
 $F_x(x) = 0, x \leq 0$
 $F_x(x) = kx^2, 0 < x \leq 10$
 $F_x(x) = 100k, x > 10$
 Calculate K. Find the values of $P(X \leq 5)$ and $P(5 < X \leq 7)$.