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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]

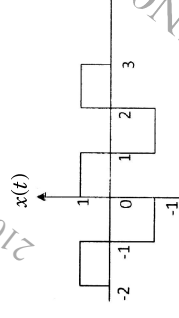
$$x_1(t) = u(t-2) \quad h(t) = u(t)$$

(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]

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- 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) $x(t) = e^{at}u(t)$.
- (c) Explain Gibb phenomenon. [3]

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

5. (a) If find Laplace Transform of : [6]
- (1) $\frac{d}{dt}(x(t))$
- (2) $tx(t)$.
- (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.

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P.T.O.

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, $f_X(X) = e^{-\frac{x}{10}}u(x)$. [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 $P(5 \leq X \leq 7)$.

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