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[5057]-242

S.E. (E&TC/Electronics) (First Semester)

EXAMINATION, 2016

SIGNALS AND SYSTEMS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Figures to the right indicate full marks.

1. (a) Perform the following operations on the given signal $x(t)$ which is defined as : [4]

$$x(t) = u(t) - u(t - 4)$$

sketch $z(t) = x(-t - 1)$

$$y(t) = x(t) + z(t).$$

- (b) Determine whether the following signal is periodic and find fundamental period : [2]

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

- (c) Compute the convolution integral by graphical method and sketch the output for : [6]

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

P.T.O.

Or

2. (a) Find whether the following signal is energy or power. Also compute corresponding value : [3]

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

- (b) Determine whether the following system is memoryless, causal and stable : [3]

$$y(t) = e^{tx(t)}.$$

- (c) An LTI system has the impulse response : [6]

$$h(t) = u(t+1) - u(t-3)$$

Determine whether the system is causal, stable and static.

3. (a) State and prove the following properties of Fourier series : [6]

(i) Frequency shift

(ii) Convolution in time.

- (b) Obtain the initial and final values of the following function : [6]

$$X(s) = \frac{2s+3}{s^2+5s+6}.$$

Or

4. (a) Obtain the Fourier transform of a rectangular pulse : [6]

$$x(t) = A \text{ rect } (t / T).$$

- (b) Find the inverse Laplace transform of the function : [6]

$$X(s) = \frac{1}{s^2+3s+2}.$$

5. (a) Find the autocorrelation of the following signal : [4]

$$x[n] = [4, 3, 2, 1],$$

\uparrow

- (b) State the properties of ESD. [3]

- (c) Find the following for the given signal $x(t)$: [6]

(i) Autocorrelation

(ii) Energy from Autocorrelation

(iii) Energy spectral density.

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

Or

6. (a) Determine cross-correlation between two sequences given below : [8]

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

\uparrow

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

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- (b) State and explain properties of autocorrelation function of energy signal. [5]

7. (a) State and prove properties of CDF. [5]

- (b) The probability density function of a random variable X is given by : [8]

$$f_X(x) = x e^{-x} u(x)$$

Determine :

(i) CDF

(ii) $P(X \leq 1)$

(iii) $P(1 < X \leq 2)$

(iv) $P(X > 2)$.

Or

8. (a) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X represents the number of heads on any triple toss. Calculate and draw the CDF and PDF. [8]
- (b) PDF of a random variable X is given by $f_X(x) = e^{-x}$ for $x \geq 0$, then find : [5]
- (i) Mean $E[X]$
- (ii) Mean square $E[X^2]$.