

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

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[4957]-1041

S.E. (Electronics/E & TC) (First Semester) EXAMINATION, 2016

SIGNALS AND SYSETMS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (v) Assume suitable data, if necessary.

1. (a) Determine even and odd components of : [6]

(i) $x[n] = \{1, 1, \underset{\uparrow}{-1}, 1, 2\}$

(ii) $x(t)$ in Fig. 1.

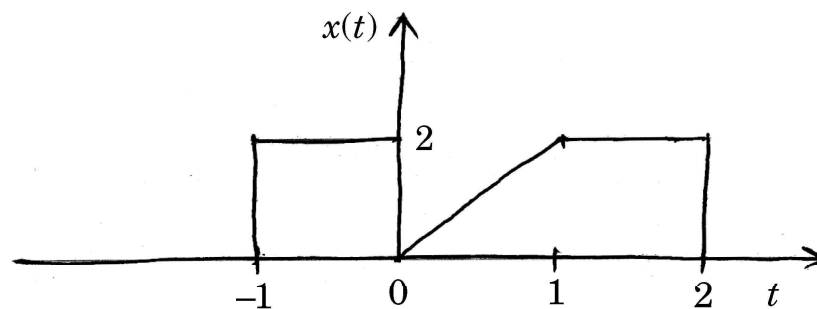


Fig. 1

P.T.O.

- (b) Determine the convolution integral of the following signals : [6]

$$x(t) = e^{-3t} u(t)$$

$$h(t) = 1, \quad 0 \leq t \leq 2.$$

Or

2. (a) Check whether the follownig system is : [6]

- (i) Static/dynamic
- (ii) Linear/non-linear
- (iii) Time invariant/time variant
- (iv) Stable/unstable.

$$y[n] = \cos(x[n - 2]).$$

- (b) Check whether the systems with impulse responses given below are : [6]

- (i) Static/dynamic
- (ii) Causal/non-causal
- (iii) Stable/unstable.

(1) $h[n] = u[n]$

(2) $h(t) = e^{-4t} u(t).$

3. (a) Determine the trigonometric Fourier series of the signal given in Fig. 2. [6]

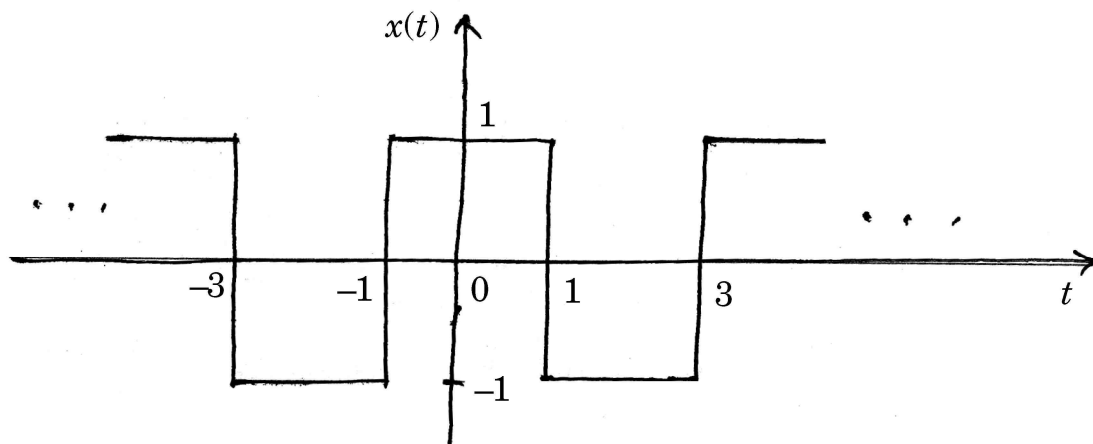


Fig. 2

- (b) Determine Laplace transform of the following signals : [6]

(i) $x(t) = \int_{-\infty}^t e^{-3\tau} \sin 4\tau u(\tau) d\tau$

(ii) $x(t) = e^{-4t}u(t) * e^{-2t}u(t).$

Or

4. (a) Determine Fourier transform of the following signals : [6]

(i) $x(t) = \frac{d}{dt} e^{-2t} u(t)$

(ii) $x(t) = \text{rect}\left(\frac{t}{2}\right) \cos \omega_0 t.$

- (b) Determine the initial and final values of the signal having Laplace transform : [6]

$$X(s) = \frac{s + 4}{s^2 + 2s + 3}.$$

5. (a) State properties of cross-correlation and prove that : [6]

$$R_{xy}(\tau) = R_{xy}(-\tau).$$

- (b) Determine autocorrelation and energy of the signal given by : [7]

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

Calculate energy from autocorrelation.

Or

6. (a) Determine autocorrelation of the sequence : [6]

$$x[n] = \{1, 2, -1, -1\}.$$

Also verify that the energy E is :

$$E = R_{xx}(0).$$

- (b) Determine power spectral density (PSD) of the signal and determine its power using the relation between PSD and power : [7]

$$x(t) = A \sin \omega_0 t.$$

7. (a) State and explain the properties of probability density function (PDF). [6]

- (b) For the cumulative distribution function (CDF) given below : [7]

$$\begin{aligned}f_x(x) &= 0, \quad x < 0 \\&= kx^2, \quad 0 \leq x \leq 10 \\&= 50k, \quad x > 10\end{aligned}$$

Determine k , PDF, $P(2 \leq X \leq 4)$, $P(X \leq 5)$.

Or

8. (a) Sketch and explain uniform distribution and determine its mean and variance. [6]
- (b) For the PDF given by : [7]

$$\begin{aligned}f_x(x) &= kx, \quad -1 \leq X \leq 2 \\&= 0, \quad \text{otherwise}\end{aligned}$$

Find k , CDF, $P(-1 \leq X < 1)$, $P(X > 1)$.