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[5152]-531

S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2017

SIGNALS AND SYSTEMS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :-** (i) Attempt 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) Figures to the right indicate full marks.
(iii) Neat diagrams must be drawn wherever necessary.
(iv) Assume suitable data, if necessary.

1. (a) Find whether the following signals are energy or power and find the corresponding value : [4]
 $x(t) = \cos(t)$.
- (b) Determine whether the following LTI system described by impulse response $h(t) = e^{-t} u(t + 1)$ is stable and causal. [4]
- (c) Find odd and even components of the following signals : [4]
 $x[n] = \{1, 0, -1, 2, 3\}$

Or

2. (a) An analog signal is given by the equation : [2]
 $x(t) = 2 \sin 400 \pi t + 10 \cos 1000 \pi t$.
- It is sampled at sampling frequency 1000 Hz :
- (i) What is the Nyquist rate for the above signal ?
(ii) What is the Nyquist interval of the signal ?

P.T.O.

- (b) Determine the convolution sum of the following sequence using equation of convolution sum : [6]

$$x(n) = \delta(n) + 2\delta(n - 2)$$

$$h(n) = 2\delta(n) - \delta(n - 2).$$

- (c) Check whether the following signal is periodic or non-periodic. If periodic, find period of the signal : [4]

$$x(t) = 10 \sin 12\pi t + 4 \sin 18\pi t.$$

3. (a) State and prove the following properties of CTFT : [6]
- (i) Time scaling
 - (ii) Time shifting.
- (b) Obtain the trigonometric Fourier series of the rectangular pulse shown in Fig. 1 : [6]

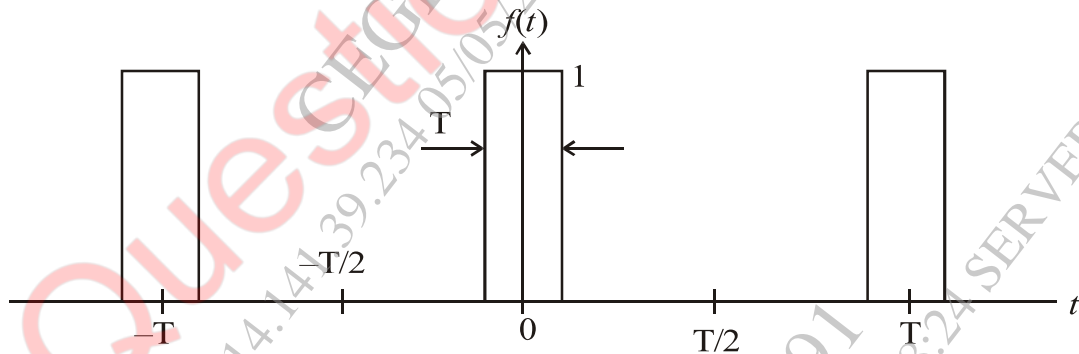


Fig. 1

Or

4. (a) State the Dirichlet conditions for existence of Fourier series. [4]

- (b) For the sinc function shown in Fig. 2, obtain Fourier transform and plot its spectrum . [8]

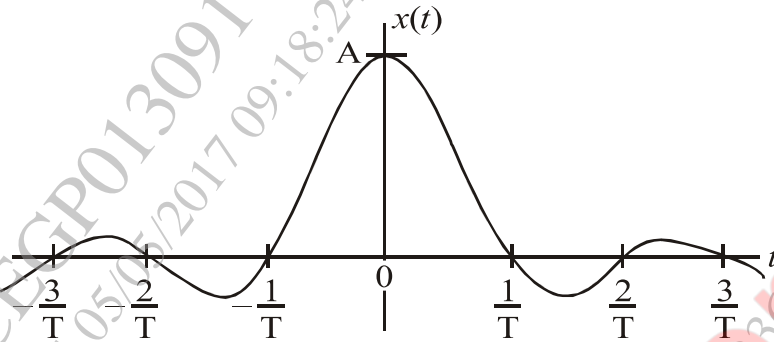


Fig. 2

5. (a) Find the initial and final value of a signal : [6]

$$X(s) = (s + 10)/(s^2 + 2s + 2).$$

- (b) Find the inverse Laplace transform of : [7]

$$X(s) = -5s - 7/(s + 1)(s - 1)(s + 2).$$

Or

6. (a) Find the Laplace transform of the following with ROC : [7]

(i) $x(t) = u(t - 5)$

(ii) $x(t) = e^{-at} \sin(\omega t) u(t)$.

- (b) The differential equation of the system is given by : [6]

$$dy(t)/dt + 2y(t) = x(t).$$

Determine the output of system for $x(t) = e^{-3t} u(t)$. Assume zero initial condition.

7. (a) What is correlation ? Explain the *two* types of correlations with a practical application for each. [6]

(b) The PDF of a random variable x is given by : [7]

$$f_x(x) = 1/2\pi \quad \text{for } 0 \leq x \leq 2\pi$$
$$= 0 \quad \text{otherwise.}$$

Calculate mean value, mean square value, variance and standard deviation.

Or

8. (a) In a pack of cards, 2 cards are drawn simultaneously. What is the probability of getting a queen, jack combination ? [6]

(b) Suppose that a certain random variable has a CDF : [7]

$$F_x(X) = 0 \quad \text{for } x \leq 0$$
$$= kx^2 \quad \text{for } 0 \leq x \leq 10$$
$$= 50k \quad \text{for } x > 10$$

(i) Determine the value of k

(ii) $P(4 \leq x \leq 7)$

(iii) Find and sketch PDF.