

2019

B.Sc. (Hons)

4th Semester Examination

ELECTRONICS

Paper - C10T

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Signals and Systems

1. Answer any five questions : 2×5=10
- (i) Define periodic and aperiodic signals.
 - (ii) What is a deterministic signal ? Give an example.
 - (iii) Mention the properties of region of convergence. in z-transform.
 - (iv) What do you mean by convolution of two functions ?
 - (v) What is the condition for system stability ?

[Turn Over]

(vi) A continuous time signal $x(t)$ is shown in figure below (Fig. 1.) Sketch & level

(a) $x(t - 2)$ (b) $x(-t)$

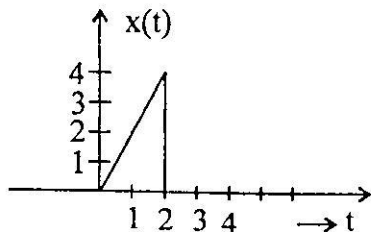


Fig - 1

- (vii) Show that product of two odd signals and two even signals are even signals where as product of an odd signal with even signal is odd signal.
- (viii) Show that complex exponential signal $x(t) = e^{j\omega_0 t}$ is periodic and its fundamental period is $\frac{2\pi}{\omega_0}$.

2. Answer any *four* questions : 4×5=20

- (i) Find the z-transform and ROC (region of convergence) of the signal

$$x(n) = -b^n u(-n-1). \quad 3+2$$

- (ii) What do you mean by linear time-invariant system ?

Consider the continuous-time system defined by $y(t) = \sin[x(t)]$. Check whether the system is time invariant or not. 1+4

- (iii) Determine if the system described by the following equations are causal or non-causal:

(a) $y(n) = x(n) + \frac{1}{x(n-1)}$

(b) $y(n) = x(n^2)$ 2½+2½

- (iv) Find the inverse z-transform of

$$X(z) = \frac{z^3 + z^2}{(z-1)(z-3)}; \text{ROC} : |z| > 3. \quad 5$$

- (v) Consider the RC circuit as shown in Fig.-2. Find the relationship between the input $x(t)$ and output $y(t)$.

[Turn Over]

(4)

(a) If $x(t) = v_s(t)$ & $y(t) = V_c(t)$

(b) If $x(t) = V_s(t)$ & $y(t) = i(t)$

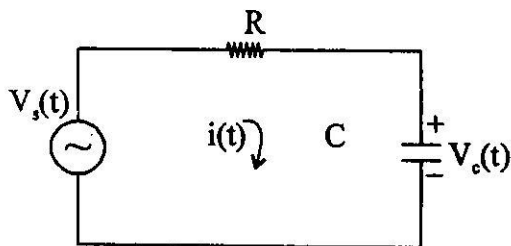


Fig-2

$2\frac{1}{2}+2\frac{1}{2}$

(vi) Find the Fourier transform of the unit impulse $\delta(t)$ & the inverse Fourier transform of $\delta(\omega)$.

3. Answer any *one* question :

$1 \times 10 = 10$

(i) (a) Find the Fourier transform of

$$f(x) = \begin{cases} 1-x^2; & |x| \leq 1 \\ 0 & ; |x| > 1 \end{cases}$$

Hence evaluate

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx .$$

(5)

- (b) State and prove the change of scale property of Fourier Transform. (3+4)+(1+2)

- (ii) (a) Find the inverse z-transform of

$$X(z) = \frac{1}{1-3z^{-1}+2z^{-2}} \text{ using convolution method.}$$

- (b) Find the poles of the system

$$y(n) - \frac{1}{4}y(n-1) + \frac{1}{4}y(n-2) - \frac{1}{16}y(n-3) = 2x(n) + 3x(n-1)$$

and determine whether the system is stable or not.

- (c) Explain the time reversal property of the z-transform. 4+(3+1)+2
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