Printed Pages– 7 Roll No. .....

B028414(028)

B. Tech. (Fourth Semester) Examination, Nov.-Dec. 2021

AICTE (~~New~~ Scheme)

(Electronics & Tele. Communication Engg. Branch)

SIGNALS & SYSTEMS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : ~~40~~ 35

Note : *Attempt all questions. Part (a) from each question is compulsory. Attempt any* ***two*** *parts from part (b), (c) and (d) of each question.*

Unit-I

1. (a) Determine whether or not each of the following signals is periodic. If a signal is periodic, determine its fundamental period. 4

(i) $x(t)=\cos\left(t+\frac{\pi}{4}\right)$

(ii) $x(t)=\sin\frac{2\pi}{3}t$

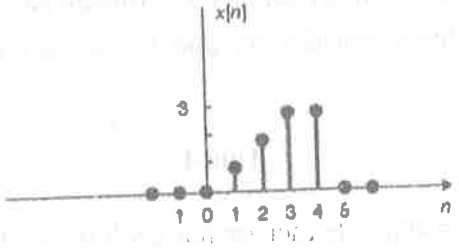
(b) A discrete-time signal $x[n]$ is shown in figure. Sketch and label each of the following signals. 8

(i) $x[n-2]$

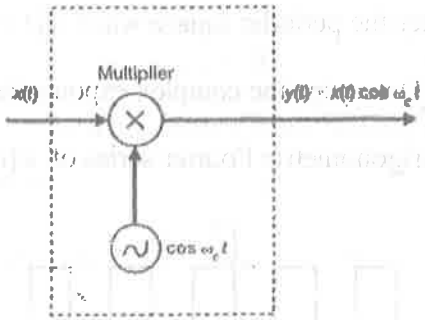
(ii) $x[2n]$

(iii) $x[-n]$

(iv) $x[-n+2]$



(c) Consider the system shown in figure. Determine whether it is (a) memoryless, (b) causal, (c) linear, (d) time-invariant, or (e) stable. 8



(d) Determine whether the following signals are energy signals, power signals, or neither. 8

(i) $x(t)=e^{-at}u(t),\ a>0$

(ii) $x(t)=A\cos(\omega_0 t+\theta)$

(iii) $x(t)=tu(t)$

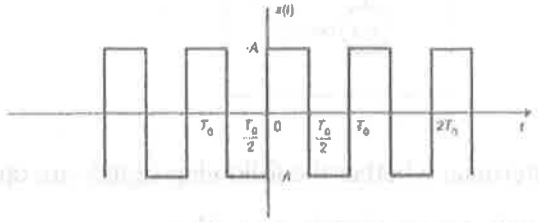
(iv) $x[n]=(-0.5)^n u[n]$

Unit-II

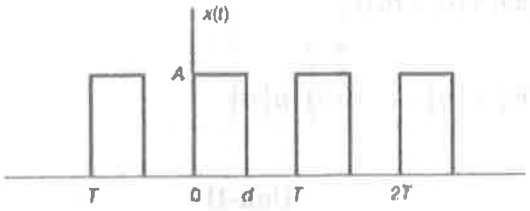
2. (a) What do you understand by complex exponential

Fourier series representation and trignometric fourier series representation. Derive the relationship between the two representations. 4

(b) Consider the periodic square wave $x(t)$ shown in figure. Determine the complex exponential Fourier series trigonometric Fourier series of $x(t)$. 8



(c) Find and sketch the magnitude spectra for the periodic square pulse train signal $x(t)$ shown in figure for (a) $d = T_0/4$ and (b) $d = T_0/8$. 8



(d) Verify the Parseval's identity for the Fourier series : 8

$$\frac{1}{T_0}\int_{T_0} |x(t)|^2 \, dt = \sum_{k=-\infty}^{\infty} |c_k|^2$$

Unit-III

3. (a) Explain any 4 peroperties of continuous-time Fourier transform. 4

(b) Find the Fourier transform of a Gaussian pulse signal. 8

$$x(t) = e^{-at^2} \quad a > 0$$

(c) Find the Fourier transforms of the following signals : 8

(i) $x(t) = 1$

(ii) $x(t) = e^{j\omega_0 t}$

(iii) $x(t) = e^{-j\omega_0 t}$

(iv) $x(t) = \cos \omega_0 t$

(d) Find the inverse Fourier transform of 8

$$X(w) = jw/(3 + jw)^2$$

Unit-IV

4. (a) What do you understand by region of convergence of z-transform. Explain any two properties of z-transform. 4

(b) Find the z-transform $X(z)$ and sketch the pole zero plot with the ROC for the following sequence. 8

$$x[n]=\left(\frac{1}{3}\right)^n u[n]+\left(\frac{1}{2}\right)^n u[-n-1]$$

(c) Find the z-transform of each of the following sequence using properties : 8

(i) $x[n]=na^n u[n]$

(ii) $x[n]=u[n-n_0]$

(d) Find the inverse z-transform of 8

$$X(z)=\frac{z}{z(z-1)(z-2)^2} \quad |z|>2$$

Unit-V

5. (a) What do you understand by LTIV system? Explain with example. 4

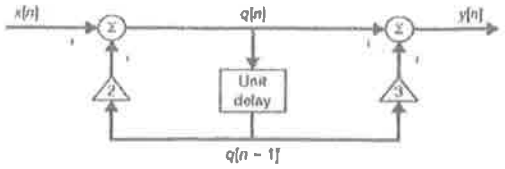
(b) The input $x[n]$ and the impulse response $h[n]$ of a discrete-time LTI system are given by : 8

$$x[n]=u[n] \quad h[n]=a^n u[n] \quad 0<\alpha<1$$

Compute the output $y[n]$.

(c) Consider the discrete-time system in fig.

Write a difference equation that relates the output $y[n]$ and input $x[n]$. 8



(d) Obtain the graphical convolution of system represented by 8

$$x(t)=e^{at}u(-t),\ h(t)=e^{-at}u(t) \text{ for } a>0$$