



Printed Pages : 4

TEC – 402

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3082

Roll No.

--	--	--	--	--	--	--	--	--	--

B. Tech.

(SEM. IV) EXAMINATION, 2006-07

SIGNAL & SYSTEM

Time : 3 Hours]

[Total Marks : 100

Note : (1) Attempt *all* questions.

(2) All questions carry *equal* marks.

1 Attempt any **four** parts of the following : **5×4**

(a) Classify signals according to signal characteristics.

(b) A continuous time linear system s with input $x(t)$ and output $y(t)$ yields the following input – output pairs :

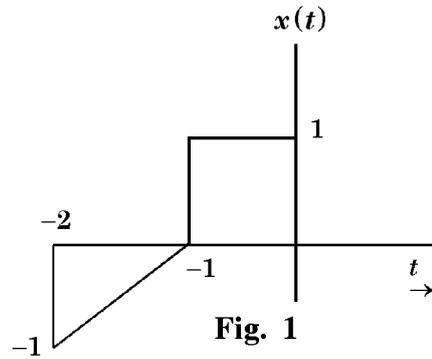
$$x(t) = e^{j2t} \rightarrow y(t) = e^{j3t}$$

$$x(t) = e^{-j2t} \rightarrow y(t) = e^{-j3t}$$

(i) if $x_1(t) = \cos(2t)$ determine the corresponding output $y_1(t)$ for system s .

(ii) if $x_2(t) = \cos(2(t - \frac{1}{2}))$ determine the corresponding output $y_2(t)$ for system s .

- (c) A discrete time signal is shown in fig.



Sketch and label carefully each of the following signal (i) $x(2t+1)$ (ii) $x(4-t/2)$.

- (d) Explain the properties of LTI system and find the convolution between of signals.

$$\mathbf{x[n] = \alpha^n u[n]}$$

$$\mathbf{h[n] = u[n]}$$

- (e) Consider a causal LTI system with $x[n]$ as input and output $y[n]$ are related by difference equation.

$$\mathbf{Y[n] = \frac{1}{4} y[n-1] + x[n]}$$

Determine $y[n]$ if $x[n] = \delta[n-1]$

- (f) What are Dirichlet's conditions.

2 Attempt any **four** parts of the following : **5×4**

- (a) Obtain the Fourier series component of the periodic square wave signals

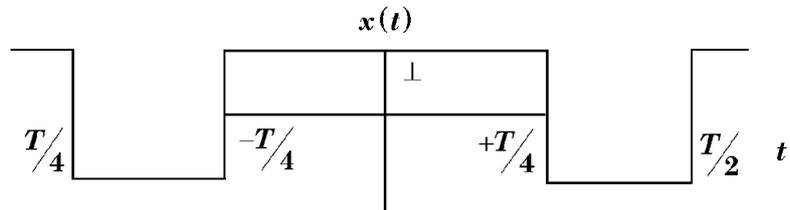


Fig. 2

- (b) Determine the fourier transform of the Gate function

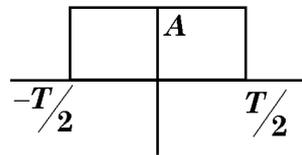


Fig. 3

- (c) Find the laplace transform of the triangular pulse.

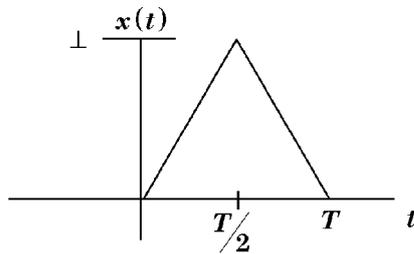


Fig. 4

- (d) Determine the magnitude spectrum of the pulse signal

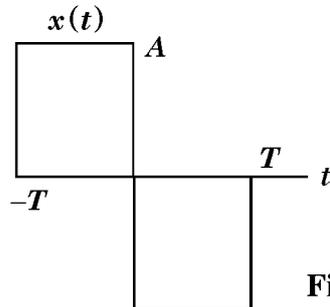


Fig. 5

- (e) Find the Fourier transform of the signal $f(t)$ shown in figure-6.

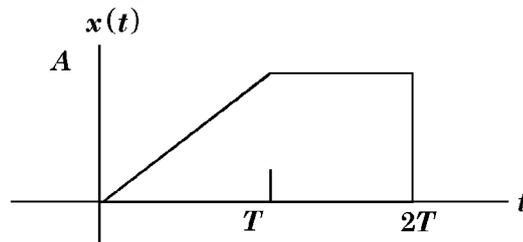


Fig. 6

- (f) Find the convolution of the signal given below using Fourier transform

$$\mathbf{x_1(n) = \left(\frac{1}{2}\right)^n u(n), \quad \mathbf{x_2(n) = \left(\frac{1}{3}\right)^n u(n)}$$

3 Attempt any **two** of the following : **10×2**

- (a) Determine the frequency response and magnitude response of the system given by

$$\mathbf{y[n] + \frac{1}{2} y[n-1] = x[n] - x[n-1]}$$

- (b) (i) Consider a causal LTI system with frequency response

$$\mathbf{H(j\omega) = \frac{1}{j\omega + 2}}$$
 for a particular input $x(t)$

this system is observed to produce the

$$\text{output } \mathbf{y(t) = e^{-2t} u(t) - e^{-3t} u(t)}$$

Determine $x(t)$

- (ii) Find the inverse laplace transform of

$$\mathbf{X(S)} = \frac{2}{(S+4)(s-1)} \text{ for all possible signal convergence.}$$

- (c) (i) Use the convolution theorem of laplace transform to find $\mathbf{y(t) = x_1(t) * x_2(t)}$ if $\mathbf{x_1(t) = e^{-3t}u(t)}$ and $\mathbf{x_2(t) = u(t-2)}$

- (ii) For a system $\mathbf{H(S) = \frac{S+2}{S^2+5S+4}}$ find the impulse response for the system function.

4 Attempt any **two** of the following : **10x2**

- (a) (i) Find the Nyquist frequency and Nyquist rate for each of the following signals :

(i) $\mathbf{x(t) = 1 + \cos (200 \pi t) + \sin (400 \pi t)}$

(ii) $\mathbf{x(t) = \frac{\sin (4000 \pi t)}{\pi t}}$

- (ii) Impulse train sampling of $r[n]$ is used to obtain :

$$\mathbf{g[n] = \sum_{K=-\infty}^{\infty} x(n) \delta [n - KN]}$$

if $\mathbf{x(e'w) = 0}$ for $\mathbf{3\pi/7 \leq |w| \leq \pi}$

Determine the largest value for the sampling interval N which ensures that no aliasing takes place while sampling $x[n]$.

- (b) (i) Find the inverse laplace transform of

$$G(s) = \frac{10s^2 e^{-s}}{(s+1)(s+3)}$$

- (ii) Solve the differential equation

$$\frac{d^2}{dt^2} x(t) + \frac{7d}{dt} x(t) + 12 x(t) = 0$$

for times $t > 0$ subject to the initial condition
 $x(0^-) = 2$ and

$$\frac{d}{dt} x(t) \big|_{t=0^-} = -4$$

- (c) Explain the following terms in brief with properties :
- (i) LTI system
 - (ii) ROC in Z transform
 - (iii) Stability condition for LTI system.

5 Attempt any **two** of the following : **10×2**

- (a) Realize the system given as

$$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n) + 2x(n-1)$$

using Z Transform with minimum no. of delay unit, assume initial condition is zero.

- (b) The input and output of a causal LTI system are related by the differential equation.

$$\frac{d^2 y(t)}{dt^2} + \frac{6 dy(t)}{dt} + 8 y(t) = 2x(t)$$

What is the response of this system if $x(t) = te^{-2t}u(t)$; assume initial condition is zero and use Fourier transform method.

- (c) (i) Discuss various properties of ideal frequency selective filters in time-domain.
(ii) A causal LTI filter has the frequency response $H(j\omega)$ shown in figure-7

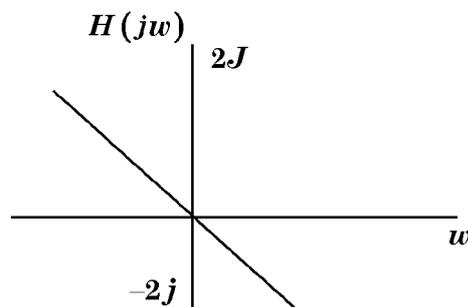


Fig. 7

Determine the filtered output signal $y(t)$ if $x(t) = e^{jt}$