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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 $x_2(t) = \cos(2(t - ½))$ determine the corresponding output $y_2(t)$ for system s.

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

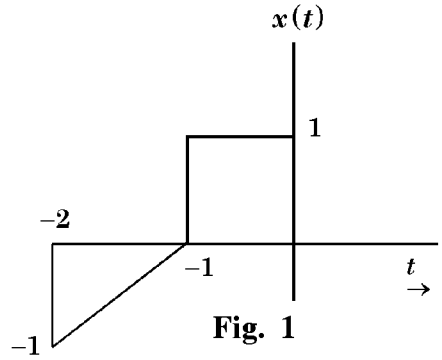

Fig. 1

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.

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

$$h[n] = u[n]$$

(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] = δ [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

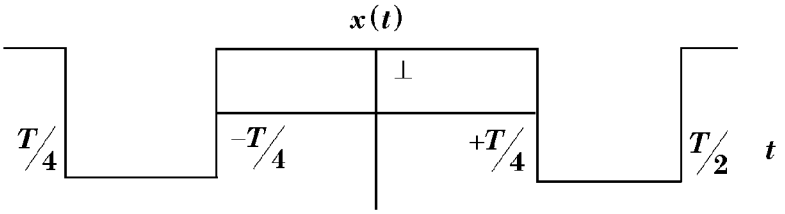

Fig. 2

(b) Determine the fourier transform of the Gate function

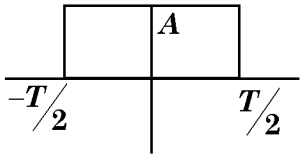

Fig. 3

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

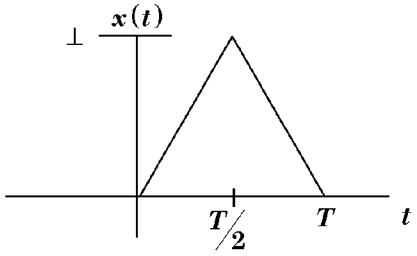

Fig. 4

(d) Determine the magnitude spectrum of the pulse signal

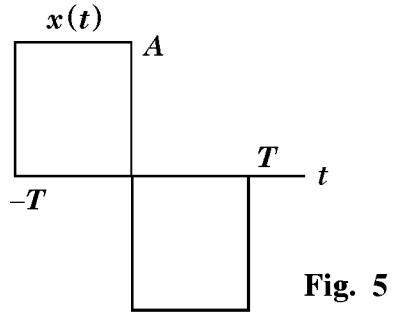

Fig. 5

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

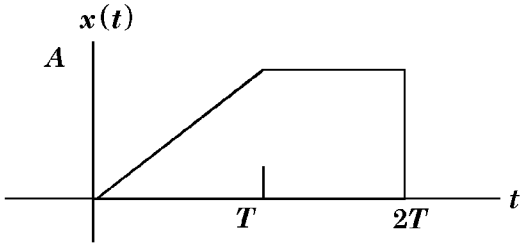

Fig. 6

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

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

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

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

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

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

$$H(jw) = \frac{1}{jw+2}$$ for a particular input x(t) this system in observed to produce the output $y(t) = e^{-2t}\, u(t) - e^{-3t} u(t)$

Determine x(t)

(ii) Find the inverse laplace transform of $X(S) = \frac{2}{(S+4)(s-1)}$ for all possible signal convergence.

(c) (i) Use the convolution theorem of laplace transform to find $y(t) = x_1(t) * x_2(t)$ if

$x_1(t) = e^{-3t}u(t)$ and $x_2(t) = u(t-2)$

(ii) For a system $H(S) = \frac{S+2}{S2+5S+4}$ find the impulse response for the system function.

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

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

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

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

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

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

if $x(e'w) = 0$ for $3\pi/7 \le |w| \le \pi$

Determine the largest value for the sampling internal 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

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

(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.

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

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(jw) shown in figure-7

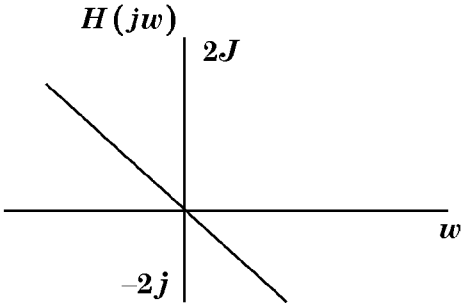

Fig. 7

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