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325554(25)

BE (5th Semester)
Examination, Nov.-Dec., 2018

(New Scheme)

Signals and Systems

Time Allowed : 3 hours *Maximum Marks :* 80
Minimum Pass Marks : 28

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

(*ii*) The figures in the right-hand margin indicate marks.

1. (*a*) Define causal signal. [2]

(*b*) Test the periodicity of the given signals. If a signal is periodic, specify its fundamental time period : [7]

(*i*) $x(n) = \cos\left(\frac{\pi}{2} + 0.3n\right)$

(*ii*) $x(t) = e^{-(1+j)t}$

(*iii*) $x(t) = 3u(t) + 2\sin 2t$

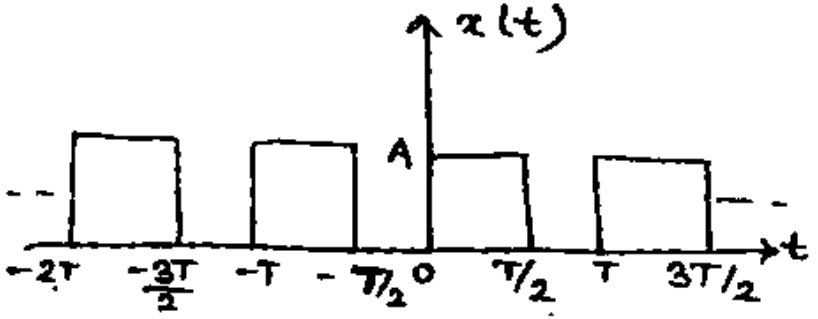
(*c*) Sketch the following signals : [7]

(*i*) $r(-t)\,u(t+2)$

(*ii*) $u(t) - 2u(t-5)$

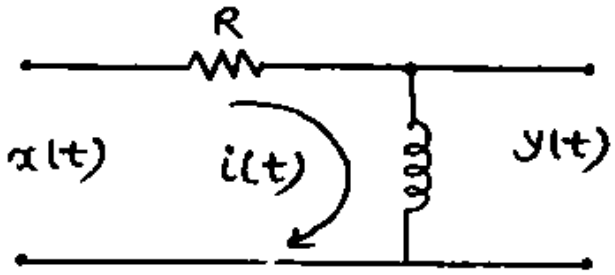
(*iii*) $r(t) - r(t-1) - r(t-3) + r(t-4)$

(*d*) Find the complex exponential Fourier series for the waveform shown in figure. [7]



2. (*a*) Define the two properties that a linear system follows. [2]

(*b*) Find whether the system shown in figure is BIBO stable or not. [7]



(c) An LTI system is described by

$$\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=x(t)$$

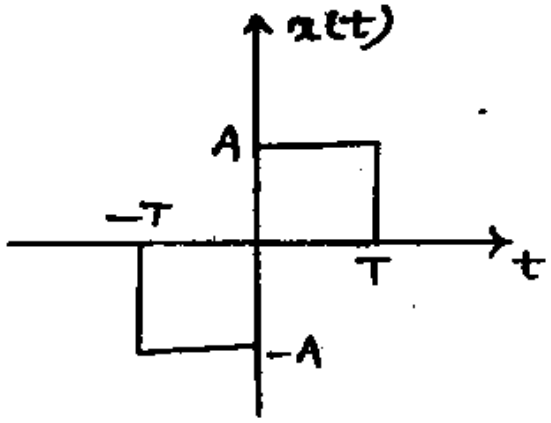
(i) Find the impulse response of the system when the initial conditions are zero.

(ii) If the initial conditions are

$$y(0^-)=\frac{[dy(0^-)]}{dt}=1,$$

find the impulse response. Also indicate the natural and forced response. [7]

(d) Find the magnitude and phase spectrum of the signal shown in figure. [7]



3. (a) What is the ROC of an infinite duration non-causal sequence? [2]

(b) Using properties of z-transform, find the z-transform : [7]

(i) $x(n)=n2^n\sin\left(\frac{\pi}{2}n\right)u(n)$

(ii) $x(n)=n\left(\frac{1}{2}\right)^{n+2}u(n+2)$

(c) Determine all possible inverse z-transform of the following $X(z)$

$$X(z)=\frac{1+2z^{-1}+z^{-2}}{1-\left(\frac{3}{2}\right)z^{-1}+\left(\frac{1}{2}\right)z^{-2}}$$

using partial fraction expansion method. [7]

(d) Find the z-transform and ROC of $X(z)$ for

$$x(n)=3\left(\frac{5}{7}\right)^n u(n)+2\left(\frac{-1}{3}\right)^n u(n)$$

Also find the pole–zero location. [7]

4. (a) What are the basic elements used to construct the block diagram of continuous time systems? [2]

(b) A system has impulse response

$$h(n)=\left(\frac{1}{3}\right)^n u(n)$$

Determine the transfer function and frequency response of the system.

Also determine the input to the system if the output is given by

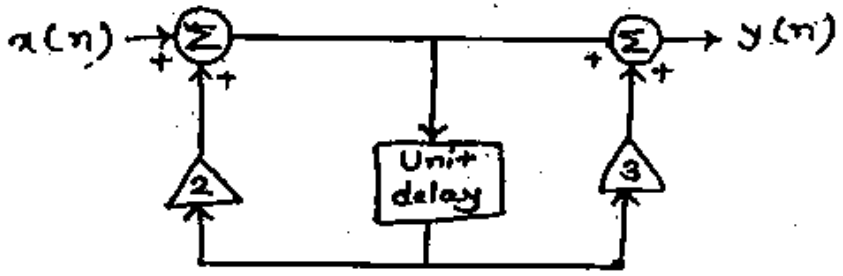
$$y(n)=\frac{1}{2}u(n)+\frac{1}{4}\left(\frac{-1}{3}\right)^{n}u(n)$$ [7]

(*c*) Solve the following difference equation

$$y(n)+2y(n-1)=x(n)$$

with $x(n)=\left(\frac{1}{3}\right)^{n}u(n)$ and the initial condition $y(-1)=1$. [7]

(*d*) Consider the discrete-time system shown in figure. Write a difference equation that relates the output $y(n)$ and the input $x(n)$. [7]



5. (*a*) What do you mean by random signals? [2]

(*b*) Explain the properties of auto-correlation function of random process. [7]

(*c*) What do you mean by Power Spectral Density? Explain the properties of PSD. [7]

 (Turn Over)

(*d*) Determine whether the function given by expression

$$f_X(x)=\begin{cases}0 \text{ for } x<2\\ \frac{1}{18}(3+2x) \text{ for } 2\le x\le 4\\ 0 \text{ for } x>4\end{cases}$$

is a probability density function. [7]

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