SE-sem-IV-CBSGS-EXTC-SS

6/6/16

QP Code : 30797

(3 Hours) **[Total Marks : 80**

N.B.:

1. **Question no.1 is compulsory**
2. **Attempt any three questions out of the remaining five.**
3. **Assume suitable data wherever necessary.**

Q I] Answer the following [20]

a) Determine if the following system is memoryless, causal, linear, time invariant

$y(t) = x^2(t-t_0) + 2$

b) Explain in brief ROC (Region of Convergence) conditions of Laplace transform.

c) Consider two LTI systems connected in series. Their impulse responses are $h_1[n]$ and $h_2[n]$ respectively. Find the output of the systems if x[n] is the input being applied to one of the systems.

$x[n]=\{1,2\}$ $h_1[n]=\{1,0,-1\}$ $h_2[n]=\{2,1,-1\}$

d) State and prove time reversal property of Continuous time Fourier Series.

e) Find energy of a causal exponential pulse $x(t) = e^{-\alpha t}u(t)$ $\alpha > 0$

Q 2] a) A DT signal is given by the following expression. Find its Z transform [10]

$$x[n] = n(-\frac{1}{2})^n u[n] * (\frac{1}{4})^{-n} u[-n]$$

b) A CT signal x(t) is applied to the input of a CT-LTI systems with unit impulse response h(t). Find out y(t) using Convolution integral. [10]

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

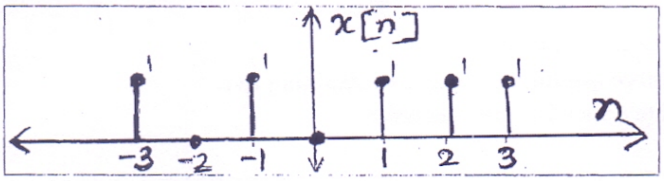
$h(t) = u(t)$

Q3] a) Consider a causal LTI system with $H(j\omega) = \frac{1}{j\omega + 2}$. For a particular input x(t), this system produces output $y(t) = e^{-2t}u(t) - e^{-3t}u(t)$. Find out x(t) using Fourier Transform. [10]

b) Obtain Inverse Laplace Transform of the function $X(s) = \frac{3S+7}{S^2 - S - 12}$ for following ROCs. Also comment on the stability and causality of the system for each of the ROC conditions. Support your answer with appropriate sketches of ROCs. [10]

i) Rs(S)>4
ii) Re(S)<-3
iii) -3<Re(S)<4

Q. 4] a) A DT signal has been shown. Sketch the following signals. [08]



i) x[n-4] ii) x[4-n] iii) x[-2n+2] iv) x[n]u[3-n]

b) Find out DTFT of the following [06]

i) x[n]={ 1,-1,2,2}

ii) $x[n] = \sin\left[\frac{\pi n}{2}\right]u[n]$

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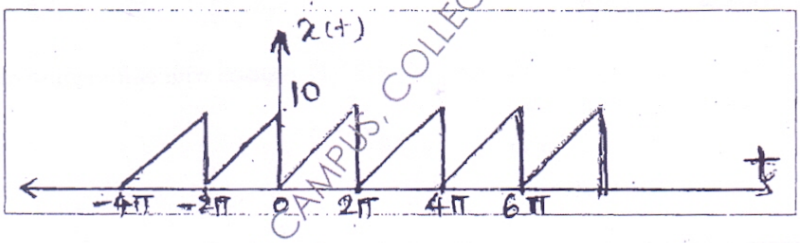
c) Determine inverse Z Transform of [06]

$$X(Z) = \frac{3}{(1-Z^{-1})(1+Z^{-1})(1-0.5Z^{-1})(1-0.2Z^{-1})}$$

Q5) a) Find the trigonometric Fourier Series for the waveform shown in the following figure. [10]



b) Determine impulse response of h[n] for the system described by the second order difference equation. y[n]-4y[n-1]+4y[n-2]=x[n]-x[n-1] when y[-1]=y[-2]=0 [10]

Q6) a) A LTI system has the following transfer function [10]

$$H(Z) = \frac{Z}{(Z-\frac{1}{4})(Z+\frac{1}{4})(Z-\frac{1}{2})}$$

i) Give all possible ROC conditions
ii) Show pole-zero diagram of a system
iii) Find impulse response of system
iv) Comment on the system stability and causality for all possible ROCs

b) Answer any two. [10]

1) The Impulse response of DT system is given by h[n]={1,2,3} and the output response is given by y[n]={1,1,2,-1,3}. Using Z transform, determine x[n] by long division method.

2) Determine the autocorrelation of the CT signal given by x(t)=A rect $\left(\frac{t}{2}\right)$.

3) For the following discrete time signals with a fundamental period of N=6, determine the Fourier Series Coefficients.

a) $x[n]=1+\cos\left(\frac{2\pi}{6}n\right)$

b) $y[n]=\sin\left(\frac{2\pi}{6}n+\frac{\pi}{4}\right)$
