Question Paper

Exam Date & Time: 28-Apr-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNAIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.S.(ENGG.)
END - SEMESTER THEORY EXAMINATIONS APRIL-2018

DATE : 28.04.2018
TIME : 9:30AM - 12:30PM
Signal Processing [EC 244A]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

1) (10)

A) The system given below have input x[n] and output y[n], respectively. Determine whether each of them is memory less, stable, causal, linear and time in-variant

i. $y[n] = \log_{10}(|x[n]|)$

ii. $y[n] = x[n]\sum_{k=-\infty}^{\infty}\delta[n-2k]$

B) (10)

Determine the even and odd component of the signal x(t) as shown in Fig. 1B

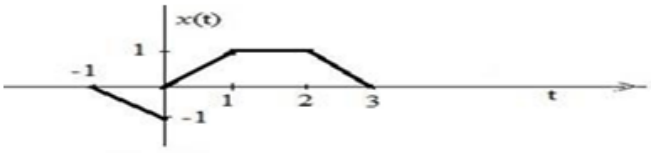

Fig. 1B

2) (10)

A) Let input to the LTI system with impulse response $h[n] = \alpha^n\{u[n-2]-u[n-13]\}$ be $x[n] = 2\{u[n+2]-u[n-12]\}$. Compute the output y[n] using convolution.

B) (10)

State and explain the following properties for the Fourier transform representation.

i. Time and Frequency shifting

ii. Convolution and Modulation

3) (10)

A)

Certain LTI system has input $x[n] = \left(\frac{1}{2}\right)^n u[n] - \left(\frac{1}{2}\right)^{n-1} u[n-1]$ and has the response $y[n] = \left(\frac{1}{2}\right)^n u[n]$.

Obtain the frequency response and the impulse response of the system. Also write the difference equation representation of the system.

B) (10)

Determine whether the following systems are causal and stable

i. $H(z)=\dfrac{2z+3}{z^2+z-\dfrac{5}{16}}$

ii. $y[n]-2y[n-2]=x[n]-\dfrac{1}{2}x[n-1]$

4) (10)

A) An LTI system has impulse response $h(t)=2\cos(6\pi t)\dfrac{\sin(\pi t)}{\pi t}$. Using Fourier transform, determine the output if the input is $x(t)=5+\sin(\pi t)+\cos(6\pi t)$.

B) (10)

Suppose the input x(t) and the impulse response h(t) of a LTI system is given by $x(t)=u(t+2)-u(t-2)$ and $h(t)=u(t-3)-u(t-10)$. Use convolution integral to evaluate the output y(t) of the LTI system. Sketch the output y(t)

5) (10)

A) Sketch the waveform for the following signal

i. $x(t)=r(t+1)-r(t)+r(t-2)$

ii. $x(t)=-u(t+3)+2u(t+1)-2u(t-1)+u(t-3)$

Where r(t) is the unit ramp and u(t) is the unit step function.

B) (10)

Draw the frequency response of the following ideal digital filters

i. Low-pass

ii. High – pass

iii. Band - pass

6) (10)

A) Determine the transfer function and difference equation representation of the system with the following impulse response

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

B) (10)

A LTI system is described $\dfrac{d^2y(t)}{dt^2}+3\dfrac{dy(t)}{dt}+2y(t)=2\dfrac{dx(t)}{dt}+x(t)$. Determine

i. Frequency response

ii. Impulse response of the system

iii. Output of the system for the input $x(t)=e^{-3t}u(t)$

7) (10)

A) Draw the DF-1 and DF-II structures for an LTI system represented by the following differential/difference equation.

i. $y[n]+1.2y[n-1]-\dfrac{1}{8}y[n-2]=2x[n]+x[n-1]$

ii. $3y(t)+6\dfrac{dy(t)}{dt}+\dfrac{d^3y(t)}{dt^3}=2x(t)+3\dfrac{dx(t)}{dt}$

B) (10)

Compare IIR and FIR filters.

8) (10)

A)

Consider the LTI system described by the difference equation

B) $7y[n$ Compute the 8 point DFT of sequence x[n] = {1 1 1 1 0 0 0 0}. (10)

Dete...ine the system function and the impulse response. Obtain the pole zero plot and hence comment on the stability and causality of the system.

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