Biomed / V / CBSGS / BDSP.   13/12/16

Biomedical Digital Signal Processing

(18)   QP Code : 564400

(3 Hours)   [Total Marks : 80

N. B. : (1) Question No. **1** is **compulsory.**

(2) Answer any **three** from remaining **five** questions.

(3) Assume any data if necessary justify.

1. (a) Check the following systems described by the input output relation is linear or not, stable or not, where x(n) is the input and y(n) is the o/p   5

(i) $y(n) = (n+1)\, e^{x(n)}$

(ii) $y(n) = x(n)\, x(n-1)$

(b) Prove the circular time shift property of DFT.   5

(c) Compute the linear convolution of $x(n) = (1,2,\underset{\uparrow}{3},-1,2,-1)$ and   5

$h(n) = (1,\underset{\uparrow}{2},1)$ using z-transform property only.

(d) Show that the filter with impulse response   5

$h(n) = (\underset{\uparrow}{0.075}, -0.1592, 0.2251, 0.75, 0.2251, -0.1592, 0.075)$ is

a linear phase filter.

2. (a) Check whether the signals are periodic or not, if periodic, find the period.   4

(i) $x(n) = e^{j7n}$

(ii) $x(n) = \cos\left(\frac{7\pi}{3}n + \pi/4\right)$

(b) Find DTFT of the signal $x(n) = \left(\frac{1}{2}\right)^n u(n)$ 4

(c) Find magnitude and phase response of the system described by the input-output relation   6

$y(n) = \frac{1}{2}\,[x(n+1) + x(n) + x(n-1)]$, where y(n) is the output and x(n) is the input.

(d) Find DFT of the signal x(n) = (1,2,3,4). From the DFT of x(n), find the DFT of the signals of $x_1(n) = (3,4,1,2)$ and $x_2(n) = (4,6,4,6)$ using properties of DFT only, not otherwise.   6

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3. (a) Develop 8-point, Radix-2 DIF FFT algoritham, draw the flow graph. Find DFT of the signal $x(n) = (0,1,2,3,4,5,6,7)$ using the above flow graph. **10**

(b) Using inverse DFT algorithm find x(n) if $X(k) = (20, 5.828-j2.414, 0, -0.172-j0.414, 0, -0.172+j0.414, 0, 5.828+j2.414)$ **10**

Draw the flow graph

4. (a) Explain over-lap and add method for finding the linear convolution of long data sequnce given **10**

$x(n) = (1,2,3,4,5,6,7,-1,1,2,3,-1,5,4,1,2)$ and $h(n) = (1,2,-1)$

(b) Realise the filter with impulse response. **10**

$$H(z) = \frac{1-\frac{1}{2}z^{-1}}{(1+\frac{1}{2}z^{-1})\,(1+\frac{1}{3}z^{-1})}$$ using direct form-I cascade and parallel form structures.

5. (a) Design a FIR filter with the following desired frequency response. **10**

$$H_d(e^{j\omega})=0 \quad \text{for } \frac{-\pi}{4}<\omega<\pi/4$$
$$=e^{-j3\omega} \quad \text{for } \frac{\pi}{4}\leq|\omega|\leq\pi$$

Determine the filter co-fffficients of h(n) if the Hamming window is used, determine the frequency response $H(e^{j\omega})$ of the designed filter.

(b) Design an IIR Butterworth filter that satisfy the following specification using bilinear transformation assume $T_s = 1$ sec. **10**

$$0.9 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq |\omega| \leq \pi/2$$
$$|H(e^{j\omega})| \leq 0.2 \quad \frac{3\pi}{4} \leq |\omega| \leq \pi$$

6. (a) Convert the analog filter transfer function $H(s) = \frac{1}{(s+1)(s+2)}$ into a digital filter transfer function using impulse invariant technique assume $T_s = 1$ sec. **6**

(b) Draw and explain briefly the architecture of any one DSP processor. **7**

(c) Explain briefly the applicationof BSP in Biomedical engineering. **7**