Roll No. | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, MAY / JUN 2013

COMPUTER SCIENCE AND ENGINEERING

30

Sixth Semester

CS9351 – Digital Signal Processing

(Regulation 2008)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 marks)

1. Is the system described by $y(n) = x\left(\frac{n}{2}\right)$ an LTIS? Justify.
2. An analog signal $x_a(t) = \sin 480\pi + 3\sin 720\pi$ is sampled 600 times per second. Does this result in aliasing. Justify.
3. How is filtering done based on DFT?
4. List two properties of DCT.
5. List the desirable properties of analog to digital mapping.
6. Can a stable IIR filter have linear phase? Justify.
7. What are the factors that influence the choice of structures for the realization of filters?
8. What is the drawback of using rectangular window for design of FIR filters?
9. List the steps involved in filtering images in the frequency domain.
10. Discuss the principle of adaptive filtering.

Part – B (5 x 16 = 80 marks)

11. (i) Obtain the DFT of the 8-point sequence $x(n) = \{2,2,2,2,1,1,1,1\}$ using DIT FFT algorithm. Also, obtain the magnitude and phase spectrum. **(10)**
    (ii) Describe the techniques for filtering long data sequences. **(4)**
    (iii) State Parseval's theorem. **(2)**

12. a) (i) Consider the interconnection of LTI systems as shown in Figure 12.
    - Express the overall impulse response in terms of $h_1(n)$, $h_2(n)$, $h_3(n)$, and $h_4(n)$. **(2)**
    - Determine h(n) when $h_1(n)=\left\{\frac{1}{2}, \underset{,}{\frac{1}{4}}, \frac{1}{2}\right\}$, $h_2(n)=h_3(n)=(n+1)u(n)$, $h_4(n)=\delta(n-2)$. **(5)**
    - Determine the response of the system if $x(n)=\delta(n+2)+3\delta(n-1)-4\delta(n-3)$ **(3)**

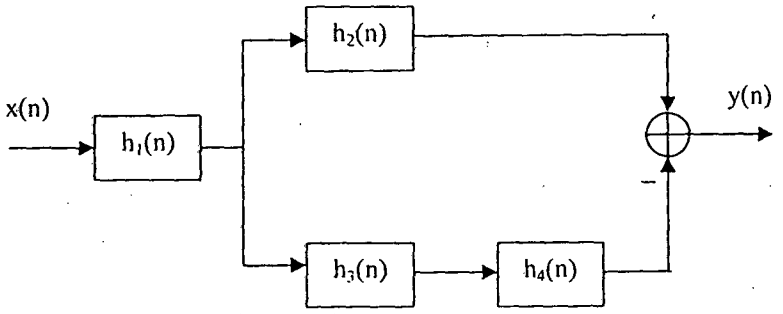

Figure 12

(ii) Determine the Z transform of $x(n) = (a^n \sin\omega_0 n)u(n)$. **(6)**

OR

b) (i) Determine the response of the system $y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$ to the input signal $x(n) = \delta(n) - \frac{1}{3}\delta(n-1)$. Also determine the impulse response of the system. **(10)**

(ii) Write notes on correlation, its properties and its applications. **(6)**

13. a) (ii) Design a Butterworth LPF for the following specifications:
Pass-band gain: -0.5 dB
Frequency upto which pass-band gain must remain more or less steady: 100 rad/s
Gain in the attenuation band: -20 dB
Frequency from which attenuation must start: 200 rad/s
Convert it to a digital filter using bilinear transformation. **(10)**

(ii) Realize the system described by the difference equation $y(n) = 2x(n) + 0.3x(n-1) + 0.5x(n-2) - 0.7y(n-1) - 0.9y(n-2)$ in DF II and transposed forms. **(6)**

OR

b) (i) Realize the given system in cascade and parallel forms.

$$H(z) = \frac{1 + \frac{1}{3}z^{-1}}{\left[1 - \frac{1}{2}z^{-1} + \frac{1}{3}Z^{-2}\right]\left[1 - \frac{1}{3}z^{-1} + \frac{1}{2}Z^{-2}\right]}.$$ **(10)**

(ii) Determine the order of Chebyshev LPF for the specifications given below:
Pass-band gain: 0.84
Frequency upto which pass-band gain must remain more or less steady: 150 rad/s
Gain in the attenuation band: 0.0316
Frequency from which attenuation must start: 300 rad/s **(6)**

14. a) (i) Obtain the linear phase realization of the system for which the impulse response is given by $h(n) = \left\{\frac{1}{3}, \frac{1}{5}, \frac{2}{3}, \frac{1}{5}, \frac{1}{3}\right\}$. **(6)**

(ii) Design a symmetric filter with $H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & \frac{-\pi}{4} \le \omega \le \frac{\pi}{4} \\ 0, & \frac{\pi}{4} \le \omega \le \pi \end{cases}$, using Hamming window. **(10)**

OR

b) (i) Design an FIR filter using frequency-sampling method from the specifications given below:
Frequency of pass-band edge: 400 Hz
Frequency from which stop-band begins: 800 Hz
Sampling frequency: 2000 Hz
Order of the filter: 10 **(10)**
(ii) Describe the effects of round off in the realization of digital filter and its remedies. **(6)**

15. a) Write notes on the following:
(i) Speech recognition **(8)**
(ii) Echo cancellation **(8)**

OR

b) Write notes on the following:
(i) Multirate DSP **(8)**
(ii) Spatial filtering **(8)**