
B.E / B.Tech (Full-Time) Degree End Semester Examinations, April/May 2014
Anna University, Chennai

Computer Science and Engineering
Sixth Semester

CS9351 – Digital Signal Processing
(Regulations 2008)

Time: 3Hrs Max Marks: 100

Answer ALL Questions

Part A – (10 * 2 = 20 marks)

1. Check whether $y(n) = e^{x(n)}$ is LTIS or not.
2. Compute the circular convolution of $x(n) = \{2,-1,0,1\}$ and $y(n) = \{1,2,-1,-2\}$.
3. Prove that the multiplication of DFTs of two sequences is equivalent to the circular convolution of the two sequences in the time domain.
4. Does FFT algorithm reduce the number of multiplications required to compute a single point of the DFT? Justify your answer.
5. Give the analog transformation for band pass filter as well as band stop filter.
6. Explain the realization of linear phase FIR system.
7. How to prevent errors due to overflow of signals?
8. What is the impact of using each bit in the A/D conversion in the signal-to-noise power ratio?
9. What are the steps involved in speech compression?
10. How does adaptive filter help in channel equalization? Illustrate with neat diagram.

Part B – (5 * 16 = 80 marks)

11. i. Determine the response, y(n) of the following system:

$h(n) = u(n+4) - u(n-3)$, $x(n) = u(n+2) - u(n-2) - \delta(n-3)$. (5)

ii. Determine the cross-correlation between x(n) and y(n) in (i). (5)

ii. Determine the Z-transform and ROC for the following sequence (6)

$x(n) = 3^n u(n+2) - 4^n u(-n-2)$

12. a. i.Compute the FFT using DIF algorithm for the sequence given by

$x(n) = 2^n$, N=8. (10)

ii. An FIR filter has the unit impulse response sequence h(n)={3,2,1}. Determine the output sequence in response to x(n)= {2,4,0,-1,2,3,-1,1,-2,3,-2} using overlap save method. (6)

(OR)

b. i. Compute the inverse FFT using DIT algorithm for X(k) = {20, -5.828-j2.414, 0, -0.172-j0.414, 0, -0.172+j0.414, 0, -5.828+j2.414}. (10)

ii. An FIR filter has the unit impulse response sequence h(n)={1,1,1}. Determine the output sequence in response to x(n)= {2,-1,0,-2,-2,-3,1,0,1,2,2} using overlap add method. (6)

13. a. Design a low pass Butterworth filter for the following specification: (16)

Passband gain : 0.8
Passband edge: - 0.2π rad/ sec
Stop band attenuation : 0.2
Stop band edge : 0.6π rad / sec

Use bilinear transformation technique with T = 1 sec and realize the designed filter in parallel form.

(OR)

b. Design a low pass Chebyshev filter for the following specification. (16)

Passband gain : -2.5dB
Passband edge: 200 rad/ sec
Stop band attenuation: – 25dB
Stop band edge : 300 rad / sec

Convert it into a HPF with pass band edge frequency and realize in Direct form II.

14. a. i. Design a FIR low pass filter for the following specification and realize it using cascade form.

$$H_d(\omega) = e^{-j4\omega} \quad |\omega| \leq \pi/4$$
$$= 0 \quad (\pi/4) \leq |\omega| \leq \pi$$

Use Hanning window for terminating the desired frequency response. (12)

ii. Explain the quantisation effects in Analog to Digital conversion. (4)

(OR)